

<b>EPA</b> United States Environmental Protection Agency Washington, DC 20460 <b>Work Assignment</b>						Work Assignment Number 4-001													
						<input type="checkbox"/> Other <input type="checkbox"/> Amendment Number:													
Contract Number EP-C-15-008			Contract Period   04/01/2015   To   03/31/2020 Base                      Option Period Number       4			Title of Work Assignment/SF Site Name Machine Shop													
Contractor JACOBS TECHNOLOGY INC.					Specify Section and paragraph of Contract SOW Section 2.0, 3.0														
Purpose: <input checked="" type="checkbox"/> Work Assignment <input type="checkbox"/> Work Assignment Close-Out <input type="checkbox"/> Work Assignment Amendment <input type="checkbox"/> Incremental Funding <input type="checkbox"/> Work Plan Approval					Period of Performance  From   04/01/2019   To   03/31/2020														
Comments: Work Plan due 4/29/19.  No work, including but not limited to preparation of the Work Plan, shall begin until 4/1/19.																			
<input type="checkbox"/> Superfund					Accounting and Appropriations Data					<input checked="" type="checkbox"/> Non-Superfund									
SFO <input type="checkbox"/> (Max 2)										Note: To report additional accounting and appropriations date use EPA Form 1900-69A.									
Line	DCN (Max 6)	Budget/FY (Max 4)	Appropriation Code (Max 6)	Budget Org/Code (Max 7)	Program Element (Max 9)	Object Class (Max 4)	Amount (Dollars)	(Cents)	Site/Project (Max 8)	Cost Org/Code									
1																			
2																			
3																			
4																			
5																			
Authorized Work Assignment Ceiling																			
Contract Period:                      Cost/Fee:                      LOF:																			
04/01/2015   To   03/31/2020																			
This Action:																			
Total:																			
Work Plan / Cost Estimate Approvals																			
Contractor WP Dated:                      Cost/Fee                      LOE:																			
Cumulative Approved:                      Cost/Fee                      LOE:																			
Work Assignment Manager Name    Richard Valentine							Branch/Mail Code:												
_____ (Signature)                      (Date)							Phone Number: 919-541-4437												
							FAX Number:												
Project Officer Name    Robin S. Harris							Branch/Mail Code:												
_____ (Signature)                      (Date)							Phone Number: 919-541-0955												
							FAX Number:												
Other Agency Official Name							Branch/Mail Code:												
_____ (Signature)                      (Date)							Phone Number:												
							FAX Number:												
Contracting Official Name    Keith Pfeffer							Branch/Mail Code:												
_____ (Signature)                      (Date)							Phone Number:												
							FAX Number:												

## **Performance Work Statement**

**WA Title:** Model, Machine, Fabrication, and Electronic Shop Support

**WA Number:** 4-001

**WACOR:** Richard E. Valentine

**Contract #:** EP-C-15-008

**Alternate WACOR:** Paul W. Groff

**Period of Performance:** April 1, 2019 through March 31, 2020

**Summary of Objectives:** The Contractor shall provide technical, trade, and craft support for pilot scale, bench scale, and measurement equipment used by the following entities at Research Triangle Park, NC: EPA/NRMRL/AEMD, NERL, NHEERL, NHSRC/DCMD, and OAQPS. Examples of support include preparation of custom designs and layouts for innovative sampling apparatus and instrumentation, installation and repair of air pollution control equipment such as combustors, baghouses, diesel engines and generators, refrigeration equipment, light-duty and heavy-duty dynamometers, wind tunnels, HVAC, and remote sampling trailers.

**Background:** the organizations listed above conduct a wide variety of pollution prevention programs in analytical laboratories and bay areas at RTP. All research apparatus requires initial fabrication and installation. Upon startup, the same equipment requires routine maintenance and repair, and may require modification based on changing program needs. The on-site Shop function provides real-time access to such support for all Principal Investigators and their associated scientists.

**Scope:** The Contractor shall provide machinists, fabricators, plumbers, electricians, and electronics technicians skilled in the design, fabrication, and assembly of research equipment from raw materials including stainless steel, aluminum, Plexiglas, Teflon, Teflon, PVC. The Contractor shall provide technicians skilled in the design, fabrication, and assembly of structural steel and scaffolding used to support sampling and analytical equipment for use at elevated locations.

The Contractor shall operate specialized equipment in the Machine and Fabrication Shop. Typical skills include machining, welding, cutting, plumbing, carpentry, and assembly of finished parts into working systems. The Contractor shall provide machinists skilled in the operation of engine lathes, milling machines, Computer-Numeric Controlled (CNC) milling machines and CNC lathes, saws, drill presses, sanders, welders, plasma cutting tables, and other standard machine shop equipment. The Contractor shall modify, or outfit research vehicles for on-road testing.

The Contractor shall provide licensed electricians for power wiring of equipment and electronic circuitry.

The Contractor shall provide electrical/electronic engineering and electronics technician support.



At the electronics technician level the Contractor shall provide the following capabilities: Design, documentation (schematic capture), fabrication, and assembly of basic circuitry including personal computer hardware, operating systems, breadboards, printed circuit boards, microcomputer, and computer networks. The Contractor shall have a basic understanding of programming languages such as C++ or Node-RED to provide programming support interfacing microcomputers such as Arduino or Raspberry PI. The Contractor shall have experience reading schematic drawings and using diagnostic equipment such as multi-meters, signal generators, and oscilloscopes. The Contractor shall have experience in fabricating custom electronic devices and cables as well as experience in the repair of scientific instrumentation such as gas analyzers, chromatographs, data acquisition systems, and standard laboratory equipment. The Contractor shall have specialized experience in troubleshooting and repair of industrial electric and electronic controls and computer-to-instrument interfaces such as RS232 and USB used on pilot and bench scale research equipment. The Contractor shall maintain an inventory of compressed gas cylinders including, but not limited to helium, zero air, and standards (VOCs and criteria gases) as required for instrument calibration.

At the electrical/electronic engineering level, the Contractor shall provide the following capabilities: creation of schematics drawings using CAD. Design, development, testing, fabrication, and assembly of complex circuitry. The Contractor shall have advanced knowledge of personal computer hardware, operating systems, printed circuit board design, sensor networks, microcomputers, telemetry systems, cellular communications, web based databases, and computer networks. The Contractor shall have knowledge of UART, SPI, I2C, RS232/422 communication protocols. The Contractor shall have experience in the development, testing, deployment, and documentation of custom software. The Contractor shall have advanced understanding of programming languages of one or more of the following: C++ (Arduino), Node-RED, Javascript, Labview, R Studio, Matlab, or HTML.

**Technical Approach:** At the direction of the WACOR, the Contractor shall prepare Shop Service Request forms for all tasks performed under the Shop WA. The Contractor representative shall meet weekly with the WACOR to discuss and prioritize the Service Requests. The Contractor shall provide the WACOR with weekly electronic time accounting which shall denote the organization for whom the work was performed. The Contractor shall maintain Government Furnished Equipment in good and proper working condition. Repairs and maintenance of Shop equipment shall be directed by the WACOR. The Contractor shall adhere to all EPA and local Health and Safety regulations, conduct good working practice, and operate in accordance with EPA/RTP's Environmental Management System (EMS) policies and the EPA/RTP Chemical Hygiene Plan. These tasks are relevant to Sections 3.0 and 6.0 of the Contract Performance Work Statement (PWS).

**Quality Assurance:** Not Required.

**Deliverables:** Completed Work Request forms shall be deliverables. Priorities shall be assigned or re-assigned by the WACOR at weekly meetings. The Contractor shall maintain the file of

completed Work Requests in the Machine Shop and update and compile the forms quarterly. Completed quarterly documents and files shall then be kept in the custody of the WACOR.

Work Assignment Form. (WebForms v1.0)

## Performance Work Statement

WA Title: Combustion Process Emissions Measurements Methods Development Support

WA #: 4-002

WACOR: Jeff Ryan

Contract #: EP-C-15-008

Alternate WACOR: Ned Shappley

Period of Performance: The period of performance detailed in this Performance Work Statement (PWS) shall be from April 1, 2019 through March 31, 2020.

NOTE: This work assignment is a follow-on to work performed in Option Period 3 under Work Assignment # 3-002.

### Summary of Objectives:

The overall objective of this project, and therefore the primary focus of this WA, is to demonstrate the readiness and quantitative measurement performance of existing and in-development manual Reference Methods and commercially available gas analyzers or CEMs for point emissions source monitoring and compliance measurement applications for multiple HAPs and pollutants of interest, including “emerging pollutants of concern”. To do so requires the development, application and demonstration of performance-based measurement approaches. A desired outcome of this work is to generate data that will support the development and revision of formal emissions measurement and monitoring procedures.

### Background:

With the implementation of ORD’s Path Forward initiative, the Air and Energy (A-E) research component includes targeted research specifically to support the Program Office’s and their emissions measurement methods development needs. Specifically, this WA is intended to support several research “Tasks” (ACE Tasks EM-1.4, EM-1.7, EM-1.1 and SEM-2.5) identified in the ACE Research Action Plan. Moreover, this WA is intended to implement research that encompasses multiple ORD and OAR emissions measurement methods development and methods evaluation topics and needs.

These include:

- Fundamental development and evaluation of formal methods to measure perfluorinated alkyl substance (PFAS) emissions from industrial sources and processes
- Investigation of total hydrocarbon (THC) analyzer measurement performance and comparability
- Investigation of extractive, instrumental ethylene oxide (EtO) emissions measurement technologies and approaches
- Evaluation of the adaptation of conventional ambient VOC measurement methods (e.g., TO-15, TO-11) to stationary source emissions by dynamic dilution
- Investigation of measurement issues associated with EPA Methods: 320, 25A and 18
- Investigation of high and low resolution Fourier Transform Infrared (FTIR) spectroscopy for the measurement/monitoring of organic and inorganic Hazardous Air Pollutants (HAPs)
- Evaluation and implementation of performance-based approaches for assessing emissions measurement data quality from instrumental measurement technologies

- Evaluation of innovative measurement/monitoring approaches and technologies

The purpose of this WA is to conduct research that targets the regulatory research needs identified above. This research support is expected to require laboratory and pilot-plant testing in order to fully understand the quality of the measurement technologies under investigation. An additional purpose of this WA is to support maintenance and operations of the Multipollutant Control Research Facility (MPCRF).

### **Scope of Work:**

#### **TASK 1. Work Plan, Reporting, Budget, And WA Management**

The contractor shall prepare and deliver to the EPA WA Contract Officer's Representative (WACOR) and to the Contract Level COR (CL COR) a work plan and budget in accordance with the WA cover page. The work plan shall include a description of how the contractor shall accomplish each task, along with a breakdown of level of effort by professional level per task; a cost breakdown per task, and any underlying assumptions used. The contractor shall conduct activities necessary to manage the WA, including at least weekly communication with the EPA WACOR.

#### **TASK 2. Preparation of WA QAPP(s)**

Several additional QAPPs are anticipated for work not covered under the existing QAPPs. These QAPPs shall be prepared primarily by the contractor as requested with guidance from the EPA WACOR. These QAPPs shall be developed according to the requirements in Appendix #1 to this PWS. The work involving environmental data shall not commence until the quality assurance documentation has received official approval from the EPA Quality Assurance Staff.

#### **TASK 3. PFAS Emissions Measurement Methods Support**

The contractor shall provide technical expertise to support PFAS emissions measurements research. This technical expertise shall include the analysis of VOC samples such as SUMMA canisters, including the evaluation of emerging PFAS compounds of interest. Technical expertise shall also be provided to perform standard laboratory sample preparation procedures, including but not limited to extractions, concentrations, as well gas chromatography (GC) mass spectrometer (MS) analysis for TBD PFAS compounds. The contractor shall also support the fabrication and operation of specialized test apparatus, such as reactors, sampling manifolds, etc., necessary to create synthetic emissions environments. This support shall also require the procurement of ancillary test equipment (e.g., sampling trains, mass flow controllers, tubing, fittings, heaters, glassware, etc.) as well as expendable supplies (e.g., analytical standards, gases, reagents, filters, etc.). The WACOR will be responsible for the preparation of a separate QAPP for this Task.

#### **TASK 4. Method 25A THC Analyzer Measurements Support**

The contractor shall provide technical expertise to support the conduct of a study to compare the measurement performance of commercial total hydrocarbon analyzers (THC) operated in accordance

with Method 25A. The contractor shall design and build the test manifold including plumbing, gas blending, interfaces and the data acquisition system. The contractor shall rent or lease the necessary THC analyzers. Two are estimated at this time. This support shall also require the procurement of ancillary test equipment (e.g., heated sample lines, mass flow controllers, tubing, fittings, heaters, glassware, etc.) as well as expendable supplies (e.g., analytical standards, gases, reagents, filters, etc.). The contractor shall be responsible for the preparation of a separate QAPP for this Task.

#### **TASK 5. Ethylene Oxide Measurement Support**

The contractor shall provide emissions measurement and sampling expertise to support ethylene oxide (EtO) emissions measurement research activities. Specifically, the contractor shall support research efforts to evaluate instrumental and manual methods to measure EtO emissions from stationary sources. Specifically, the contractor shall lease or buy prototype instrumentation, based on GC/FTIR technology, that shall be tested on multiple AEMD test equipment. The WACOR will provide additional, more detailed specifications in writing in separate communications. The contractor shall estimate the costs associated with acquiring the GC/FTIR separately and shall not procure this system without written concurrence from the WACOR to do so. The contractor shall also procure ancillary test equipment, including, but not limited to: heated sample lines of multiple construction materials, mass flow controllers, tubing, fittings, heaters, glassware, etc., as well as expendable supplies (e.g., reference gases, reagents, filters, etc.). The WACOR and Alternate WACOR will be responsible for the preparation of a separate QAPP for this Task.

#### **TASK 6. Emissions Measurement Support**

The contractor shall provide emissions measurement and sampling expertise to support emissions measurement research activities. Specifically, the contractor shall implement standard EPA methods to sample or measure for organic, inorganic, and acid gas HAPs in combustion emissions. This shall involve both manual and instrumental methodologies. Examples include, but are not limited to: M26/26A for acid gases, Method 320 (FTIR) for acid gases, VOCs, and criteria pollutants, SUMMA canisters for VOCs, and continuous emission monitors (CEMS) for gases such as THC, CO<sub>2</sub>, O<sub>2</sub>, CO, SO<sub>2</sub>, and NO<sub>x</sub>. The WACOR will be responsible for the preparation of a separate QAPP for this Task.

#### **TASK 7. Pilot-Plant Operations to Evaluate Emissions Measurements**

The contractor shall provide technical expertise to operate or support operation of combustion test facilities to provide the combustion environments necessary to evaluate emissions measurement methods and technologies. Primarily, this includes operation of EPA's Multi-Pollutant Combustion Research Facility (MPCRF) in order to establish representative measurement environments while firing on natural gas and coal combustion conditions as a minimum. In addition, various pure gases (e.g., SO<sub>2</sub>, NH<sub>3</sub>, HBr, CH<sub>4</sub>, etc.) and trace level organic gases (formaldehyde, benzene, etc.) shall be injected into the MPCRF's duct (upstream of measurements) to provide the necessary controlled measurement environments. APTB's diesel generator shall also be used for measurements testing and shall need to be operated as necessary.

**TASK 8. Multi-Pollutant Combustion Research Facility – Repair and Operational Support**

The majority of the pilot-scale research identified above shall take place using AEMD/SSB's Multi-Pollutant Control Research Facility (MPCRF). This WA shall support the repair, maintenance, and operations of this research facility. This WA shall also procure and provide fuel (primarily coal) fuel prep and fuel storage for daily operations and testing. In addition, this WA shall support the repair, maintenance, and operations of this research facility by procuring necessary repair parts (e.g., tubing, fittings, thermocouples, gauges, etc) as well as expendable materials (e.g., filters, reagents, gases, etc). Charges for the repair and maintenance of the MPCRF, including consumable and related purchases shall be tracked separately.

**TASK 9. Acquire Specialized Technical Expertise for Emissions Measurements**

The contractor shall arrange to acquire specialized technical expertise to expand AEMD measurement capabilities. Specific examples include, but are not limited to: expanded methods/approaches for AEMD's FTIR/UV emissions measurement system; refined approaches for dynamic spiking/performance-based data quality determinations; and adaptation of GC/FTIR for trace level organic measurements, including EtO. The contractor shall estimate the costs associated with acquiring this specialized technical expertise separately and shall not implement this without written concurrence from the WACOR to do so.

**Technical Approach/Objectives**

The overall objective of this WA is to fundamentally examine methods and technologies to measure multiple pollutant emissions of regulatory interest from stationary sources, including combustion sources. It is anticipated that this work will examine hot/wet extractive and dilution-based approaches and include various forms of chemical speciation. Experiments will likely require specialized testing apparatus as well as controlled emissions testing on the MPCRF.

Specific technical objectives include the development, evaluation and demonstration of PFAS and EtO emission measurement approaches and methods; the quantitative comparison of THC analyzer measurement performance under controlled conditions; and the adaptation of ambient methods by dynamic dilution.

Another significant objective of this WA is to conduct targeted testing that investigates specific issues that are related to implementation of EPA Methods 320, 25A and 18. The goal of these investigations is to evaluate potential Method measurement alternatives that may contribute to formal Method revisions.

Another objective of this WA is to evaluate FTIR, as well as other innovative monitoring technologies, as a regulatory compliance monitoring tool for select organic and acid gas HAPs. Formaldehyde, benzene, naphthalene and acrolein along with HF and HCN are of primary interest. Technology sensitivity (detection limits), proper wavelengths for quantitation, spectral interferences, status and availability of calibration standards are examples of associated considerations. The



application of ambient SUMMA canister sampling combined with dynamic dilution is also identified as a potential organic emissions measurement approach to be examined. It is anticipated that this work shall require a combination of theoretical and empirical information gathering including pilot-plant testing on the MPCRF as well as other appropriate test facilities/combustion sources.

An overarching objective of this WA is to further develop and demonstrate performance-based approaches for assessing emissions measurement data quality. These approaches are intended to comprehensively assess overall measurement quality in specific measurement environments. The ability to evaluate overall measurement accuracy, matrix effects and interferences, and limits of detection and quantitation are key elements of performance-based approaches. Dynamic spiking is the primary approach to accomplish these objectives, however the dynamic spiking approach has not been fully developed. Testing is anticipated to examine critical parameters associated with dynamic spiking – probe flow measurement accuracy, spike flow, and appropriate levels to spike as well as tracer gas measurement quality.

### **Quality Assurance**

Multiple QAPPs shall be required for this WA. These QAPPs shall be prepared primarily by the contractor with additional input from the WACOR/Alternate WACOR. The QAPPs shall be developed according to the requirements in Attachment #1 to this PWS. Work involving environmental data shall not commence until the quality assurance documentation has received official approval from the EPA Quality Assurance Staff.

### **Deliverables**

Multiple deliverables are required as a function of this WA. These include, but are not limited to:

The contractor shall prepare a work plan and budget as described in Task 1. The contractor shall prepare and submit monthly reports in accordance with the terms and conditions of the contract.

Health and Safety Protocols shall be prepared and submitted for approval as required by contractor, APPCD, and SDEM safety personnel.

The contractor shall maintain at least weekly communications with the WACOR. Additionally, the contractor shall inform the CL COR, Contracting Officer (CO), and the WACOR in writing when 75% of the total funds and/or hours contained in the work plan are expended.

Draft Data Reports - Test data summaries for each test series, including brief summaries of associated testing activities and procedures, copies of all ancillary data forms and log sheets.

Final Data Reports – All raw and summarized measurements data, QA/QC report of data quality and data limitations, if any. Data from all tests shall be reported in electronic files. They shall be assembled in individual Excel notebooks that are unique for each test. Each Excel notebook shall consist of:



- Summary page to summarize relevant information from the test
- Narrative page that shall give a description of the test, analytical method, deviations from operating procedures during the analysis, deviations from specifications in the test plan or QAPP, problems encountered during the test or analysis, questions or issues concerning individual data points, special actions taken to verify data, data that shall be further evaluated by the reviewer, and questions and issues to be addressed in preparation of the final data summary and report
- Data pages which contain all of the raw data as compiled by the individual instruments for field samples, lab samples, and QC samples
- QA/QC pages in which all pertinent QA/QC data are presented

### **Schedule of Deliverables**

Work Plan – in accordance with the WA cover page

Draft Data Reports – within 2 weeks of testing completion

Final Data Reports – schedule TBD in writing by EPA WACOR

## ATTACHMENT #1 TO THE PWS FOR MEASUREMENT & METHOD DEVELOPMENT PROJECTS

### NRMRL Quality Assurance (QA) Requirements

In accordance with EPA Order 5360.1 A2, conformance to ANSI/ASQC E4 must be demonstrated by submitting the quality documentation specified herein. All quality documentation shall be submitted to the Government for review. The Government will review and return the quality documentation, with comments, and indicate approval or disapproval. If the quality documentation is not approved, it must be revised to address all comments and shall be resubmitted to the Government for approval. Work involving environmental data collection, generation, use, or reporting shall not commence until the Government has approved the quality documentation. The quality documentation shall be submitted to the Government at least thirty (30) days prior to the beginning of any environmental data gathering or generation activity in order to allow sufficient time for review and revisions to be completed. After the Government has approved the quality documentation, the Contractor shall also implement it as written and approved by the Government. Any EPA-funded project/program may be subject to a QA audit.

#### TO BE SUBMITTED PRE-AWARD (mark all that apply):

☐ **NRMRL's Quality System Specifications:**

- (1) a description of the organization's Quality System (QS) and information regarding how this QS is documented, communicated and implemented;
- (2) an organizational chart showing the position of the QA function;
- (3) delineation of the authority and responsibilities of the QA function;
- (4) the background and experience of the QA personnel who will be assigned to the project; and
- (5) the organization's general approach for accomplishing the QA specifications in the SOW.

- ☐ **Quality Management Plan:** prepared in accordance with R-2 - EPA Requirements for Quality Management Plans (EPA/240/B-01/002) March, 2001, <http://www.epa.gov/quality/qs-docs/r2-final.pdf>

#### TO BE SUBMITTED POST-AWARD (mark all that apply):

☐ **NRMRL's Quality System Specifications:**

- (1) a description of the organization's Quality System (QS) and information regarding how this QS is documented, communicated and implemented;
- (2) an organizational chart showing the position of the QA function; 07/14/08 A-2
- (3) delineation of the authority and responsibilities of the QA function;
- (4) the background and experience of the QA personnel who will be assigned to the project; and
- (5) the organization's general approach for accomplishing the QA specifications in the SOW.

- ☐ **Quality Management Plan:** prepared in accordance with R-2 - EPA Requirements for Quality Management Plans (EPA/240/B-01/002) March, 2001, <http://www.epa.gov/quality/qs-docs/r2-final.pdf>

- ☐ **Category A (QAPP):** prepared in accordance with R-5 - EPA Requirements for QA Project Plans (EPA/240/B-01/003) March, 2001 <http://www.epa.gov/quality/qs-docs/r5-final.pdf>

- ☒ **Category B QAPP:** prepared in accordance with applicable sections of the following NRMRL QAPP Requirements List(s) which is(are) included in this attachment:

**X QAPP Requirements for Measurement Projects**

- ☐ **QAPP Requirements for Secondary Data Projects**
- ☐ **QAPP Requirements for Research Model Development and/or Application Projects**
- ☐ **QAPP Requirements for Software Development Projects**

**X QAPP Requirements for Method Development Projects**

- ☐ **QAPP Requirements for Design, Construction, and/or Operation of Environmental Technology Projects**

**ADDITIONAL QA RESOURCES:**

EPA's Quality System Website: <http://www.epa.gov/quality/>

EPA's Requirements and Guidance Documents: [http://www.epa.gov/quality/qa\\_docs.html](http://www.epa.gov/quality/qa_docs.html)

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**NRML QAPP REQUIREMENTS FOR MEASUREMENT PROJECTS**

**GENERAL REQUIREMENTS:**

Include cover page, distribution list, approvals, and page numbers.

**0. COVER PAGE**

Include the Division/Branch, project title, revision number, EPA technical lead, QA category, organization responsible for QAPP preparation, and date.

**1. PROJECT DESCRIPTION AND OBJECTIVES**

- 1.1 Describe the process and/or environmental system to be evaluated.
- 1.2 State the purpose of the project and list specific project objective(s).

**2. ORGANIZATION AND RESPONSIBILITIES**

- 2.1 Identify all project personnel, including QA, and related responsibilities for each participating organization, as well as their relationship to other project participants.
- 2.2 Include a project schedule that includes key milestones.

**3. SCIENTIFIC APPROACH**

- 3.1 Describe the sampling and/or experimental design that will be used to generate the data needed to evaluate the projective objective(s). A description of the design should include the types and numbers of samples (including QC and reserve samples), the design of the sampling network, sample locations and frequencies, and the rationale for the design.
- 3.2 Identify the process measurements (e.g., flow rate, temperature) and specific target analyte(s) for each sample type.
- 3.3 Describe the general approach and the test conditions for each experimental phase.

**4. SAMPLING PROCEDURES**

- 4.1 Describe any known site-specific factors that may affect sampling procedures as well as all site preparation (e.g., sampling device installation, sampling port modifications, achievement of steady-state) needed prior to sampling.
- 4.2 Describe or reference each sampling procedure (including a list of equipment needed and the calibration of this equipment as appropriate) to be used. Include procedures for homogenizing, compositing, or splitting of samples, as applicable.
- 4.3 Provide a list of sample containers, sample quantities to be collected, and the sample amount required for each analysis, including QC sample analysis.
- 4.4 Specify sample preservation requirements (e.g., refrigeration, acidification, etc.) and holding times.
- 4.5 Describe the method for uniquely numbering each sample.
- 4.6 Describe procedures for packing and shipping samples, including procedures to avoid cross-contamination, and provisions for maintaining chain-of-custody (e.g., custody seals and records), as applicable.

## **5 MEASUREMENT PROCEDURES**

- 5.1 Describe in detail or reference each process measurement or analytical method to be used. If applicable, identify modifications to EPA-approved or similarly validated methods.
- 5.2 If not provided in Section 5.1 or the referenced method, include specific calibration procedures, including linearity checks and initial and continuing calibration checks.

## **6 QUALITY METRICS (QA/QC CHECKS)**

- 6.1 For each process measurement and analytical method, identify the required QC checks (e.g., blanks, control samples, duplicates, matrix spikes, surrogates), the frequencies for performing these checks, associated acceptance criteria, and corrective actions to be performed if acceptance criteria are not met.
- 6.2 Any additional project-specific QA objectives (e.g., completeness, mass balance) shall be presented, including acceptance criteria.

## **7 DATA ANALYSIS, INTERPRETATION, AND MANAGEMENT**

- 7.1 Identify the data reporting requirements, including data reduction procedures specific to the project and applicable calculations and equations.
- 7.2 Describe data validation procedures used to ensure the reporting of accurate project data.
- 7.3 Describe how the data will be summarized or analyzed (e.g., qualitative analysis, descriptive or inferential statistics) to meet the project objective(s).
  - 7.3.1- If descriptive statistics are proposed, state what tables, plots, and/or statistics (e.g., mean, median, standard error, minimum and maximum values) will be used to summarize the data.
  - 7.3.2- If an inferential method is proposed, indicate whether the method will be a hypothesis test, confidence interval, or confidence limit and describe how the method will be performed.
- 7.4 Describe data storage requirements for both hard copy and electronic data.

## **8 REPORTING**

- 8.1 List and describe the deliverables expected from each project participant responsible for field and/or analytical activities.
- 8.2 Specify the expected final product(s) that will be prepared for the project (e.g., journal article, final report).

## **9. REFERENCES**

Provide references either in the body of the text as footnotes or in a separate section.

## **NRMRL QAPP REQUIREMENTS FOR METHOD DEVELOPMENT PROJECTS**

### **GENERAL REQUIREMENTS:**

Include cover page, distribution list, approvals, and page numbers.

### **0. COVER PAGE**

Include the Division/Branch, project title, revision number, EPA technical lead, QA category, organization responsible for QAPP preparation, and date.

### **1. PROJECT DESCRIPTION AND OBJECTIVES**

- 1.1 Provide a description of the situation that requires the generation of a new or modified method.
- 1.2 State the purpose of the project and list specific project objective(s).

### **2. ORGANIZATION AND RESPONSIBILITIES**

- 2.1 Identify all project personnel, including QA, and related responsibilities for each participating organization, as well as their relationship to other project participants.
- 2.2 Include a project schedule that includes key milestones.

### **3. SCIENTIFIC APPROACH**

- 3.1 Identify the specific analyte(s) of interest and the matrix/matrices under study.
- 3.2 Identify the analytical approach that will be used and how it will be optimized for this study. Also describe any tests of interference and analyte stability.
- 3.2 Identify the method performance metrics (QA/QC checks) that will be used to evaluate the method, including the procedures used. These metrics could include (but are not limited to) positive and negative controls, sensitivity, precision, accuracy, recovery, linearity, specificity, robustness, and range.

### **4. SAMPLING PROCEDURES**

- 4.1 Provide the requirements for samples that will be used to test the method (including matrix and presence/concentration of analytes).
- 4.2 If synthetic (i.e., laboratory-prepared) samples are used, describe the preparation of these samples.
- 4.3 If non-synthetic (i.e., real-world sample) samples are used, address the following:
  - describe the sampling design that will be used and the steps taken to assure that representative samples are collected
  - discuss or reference each sampling procedure
  - provide a list of sample containers, sample quantities to be collected, and the sample amount required for each analysis, including QC sample analysis
  - describe procedures for packing and shipping samples, and provisions for maintaining chain-of-custody, as applicable
- 4.4 Specify sample preservation requirements (e.g., refrigeration, acidification, etc.) and holding times.
- 4.5 Describe the method for uniquely numbering each sample.

### **5. MEASUREMENT PROCEDURES**

- 5.1 Describe in detail or reference each preparation or analytical procedure to be used, if known. Include steps for preparation, calibration, measurement, quality control, and reporting.
- 5.2 If not provided in Section 5.1 or the referenced method, include specific calibration procedures, including linearity checks and initial and continuing calibration checks.

## **6. METHOD PERFORMANCE METRICS**

For each method performance metric (QA/QC check) identified in Section 3.2, specify the frequencies for performing these checks, associated acceptance criteria, and corrective actions to be performed if acceptance criteria are not met.

## **7. DATA ANALYSIS, INTERPRETATION, AND MANAGEMENT**

- 7.1 Identify the data reporting requirements, including data reduction procedures specific to the project and applicable calculations and equations.
- 7.2 Describe data validation procedures used to ensure the reporting of accurate project data.
- 7.3 Describe how the data will be summarized or analyzed (e.g., qualitative analysis, descriptive or inferential statistics) to meet the project objective(s).
  - 7.3.1- If descriptive statistics are proposed, state what tables, plots, and/or statistics (e.g., mean, median, standard error, minimum and maximum values) will be used to summarize the data.
  - 7.3.2- If an inferential method is proposed, indicate whether the method will be a hypothesis test, confidence interval, or confidence limit and describe how the method will be performed.
- 7.4 Describe data storage requirements for both hard copy and electronic data.

## **8. REPORTING**

- 8.1 List and describe the deliverables expected from each project participant.
- 8.2 Specify the expected final product(s) that will be prepared for the project (e.g., journal article, final report, etc.). If a method/SOP will be developed, specify the required format.

## **9. REFERENCES**

Provide references either in the body of the text as footnotes or in a separate section.

<b>EPA</b> United States Environmental Protection Agency Washington, DC 20460 <b>Work Assignment</b>						Work Assignment Number 4-005								
						<input type="checkbox"/> Other <input type="checkbox"/> Amendment Number:								
Contract Number EP-C-15-008			Contract Period   04/01/2015   To   03/31/2020 Base                      Option Period Number       4			Title of Work Assignment/SF Site Name See the attached PWS								
Contractor JACOBS TECHNOLOGY INC.					Specify Section and paragraph of Contract SOW Section 2.0 A, B, D-G									
Purpose: <input checked="" type="checkbox"/> Work Assignment <input type="checkbox"/> Work Assignment Close-Out <input type="checkbox"/> Work Assignment Amendment <input type="checkbox"/> Incremental Funding <input type="checkbox"/> Work Plan Approval					Period of Performance  From   04/01/2019   To   03/31/2020									
Comments: Work Plan due 4/29/19.  No work, including but not limited to preparation of the Work Plan, shall begin until 4/1/19.														
<input type="checkbox"/> Superfund					Accounting and Appropriations Data					<input checked="" type="checkbox"/> Non-Superfund				
SFO <input type="checkbox"/> (Max 2)					Note: To report additional accounting and appropriations date use EPA Form 1900-69A.									
Line	DCN (Max 6)	Budget/FY (Max 4)	Appropriation Code (Max 6)	Budget Org/Code (Max 7)	Program Element (Max 9)	Object Class (Max 4)	Amount (Dollars)	(Cents)	Site/Project (Max 8)	Cost Org/Code				
1														
2														
3														
4														
5														
Authorized Work Assignment Ceiling														
Contract Period:		Cost/Fee:				LOF:								
04/01/2015   To   03/31/2020														
This Action:														
Total:														
Work Plan / Cost Estimate Approvals														
Contractor WP Dated:				Cost/Fee			LOE:							
Cumulative Approved:				Cost/Fee			LOE:							
Work Assignment Manager Name   Michael Hays  <div style="display: flex; justify-content: space-between;"> <div>_____ (Signature)</div> <div>_____ (Date)</div> </div>							Branch/Mail Code: Phone Number: 919-541-3984 FAX Number:							
Project Officer Name   Robin S. Harris  <div style="display: flex; justify-content: space-between;"> <div>_____ (Signature)</div> <div>_____ (Date)</div> </div>							Branch/Mail Code: Phone Number: 919-541-0955 FAX Number:							
Other Agency Official Name  <div style="display: flex; justify-content: space-between;"> <div>_____ (Signature)</div> <div>_____ (Date)</div> </div>							Branch/Mail Code: Phone Number: FAX Number:							
Contracting Official Name   Keith Pfeffer  <div style="display: flex; justify-content: space-between;"> <div>_____ (Signature)</div> <div>_____ (Date)</div> </div>							Branch/Mail Code: Phone Number: FAX Number:							

## **Performance Work Statement**

WACOR: Michael D. Hays; Alt WA-COR: Pamela Barfield

**WA title:** Analytical laboratory support for the physical and chemical characterization of organic gases and PM2.5

**Contract #:** EP-C-15-008

**Period of Performance:** 04-01-2019 thru 03-31-2020

**NOTE:** This work assignment continues work performed in Option Period 3 under Work Assignment 3-005.

### **1 SUMMARY OF OBJECTIVES**

The work assignment objective is to provide the Fine PM Characterization Laboratory (FPMCL) technical support for the chemical characterization of fine particulate matter (PM2.5) filter samples collected from a variety of combustion sources. Support for the chemical analysis of semi-volatile organic compounds (SVOCs) and gas-phase samples collected on polyurethane foam plugs (PUFs), SUMA canisters, and similar sampling media or devices shall also be provided. The contractor shall be responsible for the characterization of (1) gas- and particle-phase emissions from residential- and industrial-scale boilers and (2) samples from emissions tests conducted with jet engines and with vehicles or generators burning diesel, bio-diesel, and ethanol-gas fuel blends. Characterization of near-source samples including those collected near roadways, biomass burning, industrial or commercial activities or similar polluted environments shall be necessary. Before analysis of any sample set the contractor shall seek the technical direction of the WACOR. In some cases, the WACOR will direct the contractor to provide samples to other authorized laboratory personnel for specialized sample analysis. An additional objective shall be to provide the WACOR with a written report either monthly or upon completion of the chemical and physical characterization of an emissions source.

### **2 BACKGROUND**

The Air and Energy Management Division's (AEMD) Distributed Source and Buildings Branch (DSBB) conducts research on PM2.5 and aerosol emissions as they pertain to the implementation of the National Ambient Air Quality Standards (NAAQS). Measurement of the physical and chemical properties of both gas- and particle-phase emissions is a research priority for DSBB. These measurements are used as input to National emissions inventories and to establish global air quality trends and to understand related public health effects. Chemical source profiles are also used in source-receptor models that apportion ambient gases and PM2.5 to various anthropogenic and natural emissions sources. NRMRL-DSBB aims to characterize gas- and particle-phase source emissions and to develop and evaluate methods to measure and prevent these emissions. This Work Assignment seeks to update and upgrade source emissions profiles and PM2.5 mass emissions factors while improving the quality of data used for dispersion and source-receptor modeling and for evaluating current risk management and regulatory strategies.

In summary, the objectives of this project are to physically and chemically characterize source-related gas and PM2.5 samples for: (i) gathering and improving chemical source profiles; (ii) accurately apportioning ambient organic matter; (iii) improving fine PM mass and individual gas and PM component emission factors; and for (iv) supporting health and toxicological research.

### **3 SCOPE**

In fulfillment of the objectives of this Work Assignment, the following Tasks listed below shall be performed by the Contractor. Throughout the course of performing these Tasks, the Contractor shall comply with (1) an approved QAPP, (2) a QAPP to be submitted for approval, (3) approved standard operating procedures (SOP) from similar previous work, (4) all relevant QAPP addendums and (5) the FPMCL Facility Manual. All work shall be conducted using these existing documents. Moreover, the contractor shall follow all issued standard operating procedures (SOP), chemical hygiene, and Laboratory related health and safety plans. In accordance with laboratory protocols established by the EPA for analysis of volatile and semi-volatile organic gases and PM2.5 samples, the contractor shall acquire laboratory supplies and consumables needed to accomplish the technical laboratory support work described below. The analytical protocols will be provided to the Contractor by the EPA WACOR prior to initiation of the technical work.



#### 4 TECHNICAL APPROACH AND OBJECTIVES

1. The contractor shall determine the purity of each new lot of extraction solvents and, as necessary, purify any solvents that may be contaminated. The solvents shall be of sufficient purity to enable extraction and analysis of the samples and shall not contain interfering contaminants that may detract from the Data Quality Objectives of the project. The Data Quality Objectives shall be specified in the project QAPPs as stated above. The purity of the solvent shall be documented by the contractor and identification of the solvent lot used for sample extraction shall be reported by the contractor. The contractor shall include this information in the monthly written progress reports. Alternatively, this information shall be contained in the final report written for each source following the completion of its characterization. Biological fluids such as simulated lung or gastric fluids or bronchial lavage fluids may also be used as part of this project.
2. The contractor shall clean substrates, sampling train components, and sample containers for collection of gases, liquids, and PM<sub>2.5</sub>, for field deployment, or for in-house sampling campaigns. Sample substrates and blanks may include Teflon membrane and quartz fiber filters, XAD-coated annular denuders, aluminum foil, XAD impregnated quartz filters, glass beads, PUF (polyurethane foam plugs) and various SUMA canisters. Also, the contractor shall provide clean glassware for use in the analyses of the PM samples. Decontamination methods shall involve various solvent rinses and/or high temperature thermal removal of contaminants as described in the facility manual.
3. The contractor shall condition and weigh Teflon filters and Al foil substrates before and after PM sample collection in accordance with established EPA weighing procedures and quality control.
4. The contractor shall maintain a sample custody log of samples submitted for analysis following sample collection. For most cases, it shall be necessary for a number of individual samples from a single source to be composited, thereby requiring careful recording of the composited samples. Before samples are composited, the contractor shall notify the WACOR of the intention to do so. The WACOR will also notify the contractor of the analytical method to be applied prior to analyzing any sample set.
5. Using protocols established and supplied by the EPA WACOR, the contractor shall perform solvent or thermal extractions of particulate matter and semi-volatile organic matter samples collected on various media substrates. Samples shall be prepared so that analyte concentrations are appropriate for precise and accurate quantitative analysis of individual trace organic compounds and major inorganic ions. Once the individual species are identified and quantified in the PM mixture, the contractor shall report the raw and processed data and appropriate proof of the data quality to the WACOR. The contractor shall also be responsible for running library searches on chromatographic data for the tentative identification of organic molecules in the PM extracts. The results of each search shall be reported by the contractor and compared against an appropriate blank to ensure validity. For quantified compounds, the contractor shall report whether (1) standards were available, (2) the compounds were within the calibration range, (3) the quantified compounds were above or below minimum detectable or quantifiable levels, and (4) the type of model used to fit calibration data. The contractor shall perform an identical set of functions for the gas-phase pre-concentration system used to analyze volatile organic compounds (VOCs), many of which are hazardous air pollutants.
6. Following a procedure established and provided by the EPA WACOR, the contractor shall perform derivatization of polar organic compounds that enables quantitative resolution of such compounds via gas chromatography/mass spectrometry. Suitable standards shall also be derivatized by the contractor and used to (1) estimate deuterated standard recoveries (by making multiple GC/MS runs of the deuterated standards during a sample run sequence) and (2) to populate appropriate calibration database levels. Documentation of data quality for the derivatization steps shall be performed by the contractor. This data quality documentation shall be linked to specific PM extract samples analyzed by GC/MS. The contractor shall purchase derivatization equipment needed to conduct on-line or in-situ methylation and silylation experiments. Purchased equipment shall be compatible with the GC-MS technology and instrumentation available in the FPMCL and shall include an auto-sampler device.
7. The contractor shall provide for appropriate handling and disposal of all laboratory waste solvents and other laboratory waste materials.
8. The contractor shall operate, maintain, and modify, as necessary, analytical instrumentation and ancillary equipment in the EPA FPMCL. Note: this Task includes ensuring appropriate instrument gases are provided (e.g., He, H<sub>2</sub>, N<sub>2</sub>, and air). The contractor shall maintain a file of operating manuals for all equipment and instruments. Equipment and instruments included in this Task are:
  - (a) HP-7890/7000 Auto sampler/Gas Chromatograph/MSD (qqq) in Room E580-A
  - (b) HP-6890/5793 Thermal extraction unit/2-dimensional Gas Chromatograph/MSD/ in E589-A
  - (c) HP-6890/5793 VOC pre-concentrator (ENTECH Inc) Gas Chromatograph/MSD/ in E288
  - (d) HPLC-MS (Q-TOF) and N<sub>2</sub>-generator in E589

- (e) Zymark TurboVap solvent concentrator in E580-A
  - (f) Cryofreezer in E580
  - (g) Fisher Isotemp muffle furnace in E569
  - (h) Skutt ceramic kiln in E578-A
  - (i) Nuaire horizontal clean bench in E578-A
  - (j) Sunset Thermal-Optical Elemental/Organic Carbon Analyzers in E-581-A and E589
  - (k) Thelco convection oven in E581-A
  - (l) Ainsworth semi-micro balance in E581-A or high-bay area
  - (m) Dionex 120 ion chromatograph in E581-A
  - (n) Sartorius MC5 microbalance in E580-A item Cahn ultra microbalance in E580-A
  - (o) Terra Universal modular clean room in E580-A
  - (p) Dracor water purification system in E581-A
  - (q) Frigidaire commercial freezer and additional cryo-freezer units in E578
  - (r) Dommic-Hunter hydrogen generators (2) in E581-A
  - (s) HP-6890/5793 Thermal extraction unit/Gas Chromatograph/MSD/FID in E580-A
9. The contractor shall maintain a complete and up-to-date chemical inventory for the FPMCL Facility along with Material Safety Data Sheets for all chemicals.
10. The contractor shall update, as needed, the Facility Manual for the PM2.5 Analytical Facility which includes as a minimum the following items:
- (a) General facility lay-out
  - (b) List of equipment by name, serial and model no, custodial account ID, EPA decal no., and location
  - (c) Computer software and hardware
  - (d) Safety/Health protocols
  - (e) Quality Assurance and Control protocols
  - (f) Sampling and Analysis Methods (ASTM, EPA, Miscellaneous Operating Procedures)
11. With the exception of the miscellaneous operating procedures (MOPs) for cleaning sample substrates, laboratory glassware, and sampling train components for which the Contractor shall be responsible, the QA/QC protocols, analytical protocols, and other MOPs will be provided by the EPA WACOR for incorporation into the Facility Manual. The Facility Manual is a working document and will incorporate new material as protocols are established or modified and additional equipment is acquired.
12. The contractor shall supply to the WACOR on a monthly basis a written progress report that includes: (1) a list by identification number of the samples analyzed; (2) the type of analysis done; (3) the results and data analysis; (4) a brief interpretation of the results; (5) future work planned in the laboratory; (6) proof of data quality; (7) description of experimental procedure used and any observed anomalous behavior; and (8) description of laboratory operations; The contractor shall also provide to the WACOR electronic copies of completed data sets and data analysis by source. In the event that the analysis of sample substrates from a single test source are completed, the contractor shall produce a written report describing the results of the analysis, the source sampling test conditions, and any other pertinent particle sizing and/or counting data.

## **5 INSTRUMENT AND EQUIPMENT EXPECTATIONS**

In addition to the above, the contractor shall research the possibility of further automating the micro- solvent extraction, filtering, and concentration techniques. In consultation with the WACOR, the contractor shall purchase technology that improves the analytical sample throughput or speed at which these steps can be conducted. Additional sampling equipment shall also be purchased in the event there is a need to complete a project in a timely manner.

## **6 QUALITY ASSURANCE**

All PWS activities described in Section IV are covered by a quality assurance project plan (QAPP) developed within NRMRL. The QAPP is entitled: "Chemical analysis of fine particulate matter". It is an EPA category B measurement plan and identified as QTRAK# 99002/III. The contractor shall abide by this QAPP.

## **7 LABOR MIX**

To achieve the objectives of the WA the following labor mix is required: (1) a person with extensive experience in chemical analysis using chromatography (GC-MS/FID, LC-MS, etc.). This individual shall have at least 20 years of GC-MS experience and be familiar with the extraction and pre-concentration procedures used for PM and miscellaneous organic gases. This individual shall be responsible for GC-MS (qqq) analysis and interpretation of GC-MS data as stated above. This person shall follow all the required QA/QC procedures established in any relevant QA protocols and shall be required to communicate results to the WACOR. This individual shall also be responsible for certain research pursuits as they relate to the analysis of GC-MS data, including library searches and the application of identified deconvolution algorithms. The contractor shall ultimately be responsible for the GC-MS data quality provided to the WACOR. (2) an individual who assists with extractions, sampling and media pretreatment and sample handling, and other similar logistical tasks shall occasionally be needed.

## **8 SCHEDULE OF DELIVERABLES**

The contractor shall deliver: (1) a report and data worksheet containing volatility basis set (VBS) and SVOC emission factor results from a West Virginia University dynamometer study investigating organic matter emitted from gasoline direct injection vehicles. The analysis shall be performed using TE-GC-MS and Carbotrap tubes (due on or before July 31, 2019); (2) a report detailing VBS and SVOC emission factor results for biomass burning tests (woodstoves and wildfires) performed at EPA facilities (due on or before October 31, 2019); (3) a report on SVOC emissions from cookstoves (due on or before March 31, 2020).

<b>EPA</b> United States Environmental Protection Agency Washington, DC 20460 <b>Work Assignment</b>						Work Assignment Number 4-005				
						<input type="checkbox"/> Other <input checked="" type="checkbox"/> Amendment Number: 000001				
Contract Number EP-C-15-008			Contract Period                      To Base                                      Option Period Number      4			Title of Work Assignment/SF Site Name				
Contractor JACOBS TECHNOLOGY INC.					Specify Section and paragraph of Contract SOW					
Purpose: <input type="checkbox"/> Work Assignment <input type="checkbox"/> Work Assignment Close-Out <input checked="" type="checkbox"/> Work Assignment Amendment <input type="checkbox"/> Incremental Funding <input type="checkbox"/> Work Plan Approval					Period of Performance  From 04/01/2019 To 03/31/2020					
Comments: The purpose of this Amendment (000001) is to revise the PWS, as attached.  A revised Work Plan is due within 20 calendar days.										
<input type="checkbox"/> Superfund                                      Accounting and Appropriations Data <input checked="" type="checkbox"/> Non-Superfund										
SFO <input type="checkbox"/> (Max 2)                                      Note: To report additional accounting and appropriations date use EPA Form 1900-69A.										
Line	DCN (Max 6)	Budget/FY (Max 4)	Appropriation Code (Max 6)	Budget Org/Code (Max 7)	Program Element (Max 9)	Object Class (Max 4)	Amount (Dollars)	(Cents)	Site/Project (Max 8)	Cost Org/Code
1										
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Authorized Work Assignment Ceiling										
Contract Period:		To		Cost/Fee:		LOF:				
This Action:										
Total:										
Work Plan / Cost Estimate Approvals										
Contractor WP Dated:				Cost/Fee			LOE:			
Cumulative Approved:				Cost/Fee			LOE:			
Work Assignment Manager Name    Michael Hays  <div style="display: flex; justify-content: space-between;"> <div>_____</div> <div>_____</div> </div> <div style="display: flex; justify-content: space-between;"> <div>(Signature)</div> <div>(Date)</div> </div>							Branch/Mail Code: Phone Number: 919-541-3984 FAX Number:			
Project Officer Name    Robin S. Harris  <div style="display: flex; justify-content: space-between;"> <div>_____</div> <div>_____</div> </div> <div style="display: flex; justify-content: space-between;"> <div>(Signature)</div> <div>(Date)</div> </div>							Branch/Mail Code: Phone Number: 919-541-0955 FAX Number:			
Other Agency Official Name  <div style="display: flex; justify-content: space-between;"> <div>_____</div> <div>_____</div> </div> <div style="display: flex; justify-content: space-between;"> <div>(Signature)</div> <div>(Date)</div> </div>							Branch/Mail Code: Phone Number: FAX Number:			
Contracting Official Name    Keith Pfeffer  <div style="display: flex; justify-content: space-between;"> <div>_____</div> <div>_____</div> </div> <div style="display: flex; justify-content: space-between;"> <div>(Signature)</div> <div>(Date)</div> </div>							Branch/Mail Code: Phone Number: FAX Number:			

## **Performance Work Statement**

WACOR: Michael D. Hays; Alt WA-COR: Pamela Barfield

**WA title:** Analytical laboratory support for the physical and chemical characterization of organic gases and PM2.5

**Contract #:** EP-C-15-008

**Period of Performance:** 04-01-2019 thru 03-31-2020

**NOTE:** This work assignment continues work performed in Option Period 3 under Work Assignment 3-005.

### **1 SUMMARY OF OBJECTIVES**

The work assignment objective is to provide the Fine PM Characterization Laboratory (FPMCL) technical support for the chemical characterization of fine particulate matter (PM2.5) filter samples collected from a variety of combustion sources. Support for the chemical analysis of semi-volatile organic compounds (SVOCs) and gas-phase samples collected on polyurethane foam plugs (PUFs), SUMA canisters, and similar sampling media or devices shall also be provided. The contractor shall be responsible for the characterization of (1) gas- and particle-phase emissions from residential- and industrial-scale boilers and (2) samples from emissions tests conducted with jet engines and with vehicles or generators burning diesel, bio-diesel, and ethanol-gas fuel blends. Characterization of near-source samples including those collected near roadways, biomass burning, industrial or commercial activities or similar polluted environments shall be necessary. Before analysis of any sample set the contractor shall seek the technical direction of the WACOR. In some cases, the WACOR will direct the contractor to provide samples to other authorized laboratory personnel for specialized sample analysis. An additional objective shall be to provide the WACOR with a written report either monthly or upon completion of the chemical and physical characterization of an emissions source.

### **2 BACKGROUND**

The Air and Energy Management Division's (AEMD) Distributed Source and Buildings Branch (DSBB) conducts research on PM2.5 and aerosol emissions as they pertain to the implementation of the National Ambient Air Quality Standards (NAAQS). Measurement of the physical and chemical properties of both gas- and particle-phase emissions is a research priority for DSBB. These measurements are used as input to National emissions inventories and to establish global air quality trends and to understand related public health effects. Chemical source profiles are also used in source-receptor models that apportion ambient gases and PM2.5 to various anthropogenic and natural emissions sources. NRMRL-DSBB aims to characterize gas- and particle-phase source emissions and to develop and evaluate methods to measure and prevent these emissions. This Work Assignment seeks to update and upgrade source emissions profiles and PM2.5 mass emissions factors while improving the quality of data used for dispersion and source-receptor modeling and for evaluating current risk management and regulatory strategies.

In summary, the objectives of this project are to physically and chemically characterize source-related gas and PM2.5 samples for: (i) gathering and improving chemical source profiles; (ii) accurately apportioning ambient organic matter; (iii) improving fine PM mass and individual gas and PM component emission factors; and for (iv) supporting health and toxicological research.

### **3 SCOPE**

In fulfillment of the objectives of this Work Assignment, the following Tasks listed below shall be performed by the Contractor. Throughout the course of performing these Tasks, the Contractor shall comply with (1) an approved QAPP, (2) a QAPP to be submitted for approval, (3) approved standard operating procedures (SOP) from similar previous work, (4) all relevant QAPP addendums and (5) the FPMCL Facility Manual. All work shall be conducted using these existing documents. Moreover, the contractor shall follow all issued standard operating procedures (SOP), chemical hygiene, and Laboratory related health and safety plans. In accordance with laboratory protocols established by the EPA for analysis of volatile and semi-volatile organic gases and PM2.5 samples, the contractor shall acquire laboratory supplies and consumables needed to accomplish the technical laboratory support work described below. The analytical protocols will be provided to the Contractor by the EPA WACOR prior to initiation of the technical work.



#### 4 TECHNICAL APPROACH AND OBJECTIVES

1. The contractor shall determine the purity of each new lot of extraction solvents and, as necessary, purify any solvents that may be contaminated. The solvents shall be of sufficient purity to enable extraction and analysis of the samples and shall not contain interfering contaminants that may detract from the Data Quality Objectives of the project. The Data Quality Objectives shall be specified in the project QAPPs as stated above. The purity of the solvent shall be documented by the contractor and identification of the solvent lot used for sample extraction shall be reported by the contractor. The contractor shall include this information in the monthly written progress reports. Alternatively, this information shall be contained in the final report written for each source following the completion of its characterization. Biological fluids such as simulated lung or gastric fluids or bronchial lavage fluids may also be used as part of this project.
2. The contractor shall clean substrates, sampling train components, and sample containers for collection of gases, liquids, and PM<sub>2.5</sub>, for field deployment, or for in-house sampling campaigns. Sample substrates and blanks may include Teflon membrane and quartz fiber filters, XAD-coated annular denuders, aluminum foil, XAD impregnated quartz filters, glass beads, PUF (polyurethane foam plugs) and various SUMA canisters. Also, the contractor shall provide clean glassware for use in the analyses of the PM samples. Decontamination methods shall involve various solvent rinses and/or high temperature thermal removal of contaminants as described in the facility manual.
3. The contractor shall condition and weigh Teflon filters and Al foil substrates before and after PM sample collection in accordance with established EPA weighing procedures and quality control.
4. The contractor shall maintain a sample custody log of samples submitted for analysis following sample collection. For most cases, it shall be necessary for a number of individual samples from a single source to be composited, thereby requiring careful recording of the composited samples. Before samples are composited, the contractor shall notify the WACOR of the intention to do so. The WACOR will also notify the contractor of the analytical method to be applied prior to analyzing any sample set.
5. Using protocols established and supplied by the EPA WACOR, the contractor shall perform solvent or thermal extractions of particulate matter and semi-volatile organic matter samples collected on various media substrates. Samples shall be prepared so that analyte concentrations are appropriate for precise and accurate quantitative analysis of individual trace organic compounds and major inorganic ions. Once the individual species are identified and quantified in the PM mixture, the contractor shall report the raw and processed data and appropriate proof of the data quality to the WACOR. The contractor shall also be responsible for running library searches on chromatographic data for the tentative identification of organic molecules in the PM extracts. The results of each search shall be reported by the contractor and compared against an appropriate blank to ensure validity. For quantified compounds, the contractor shall report whether (1) standards were available, (2) the compounds were within the calibration range, (3) the quantified compounds were above or below minimum detectable or quantifiable levels, and (4) the type of model used to fit calibration data. The contractor shall perform an identical set of functions for the gas-phase pre-concentration system used to analyze volatile organic compounds (VOCs), many of which are hazardous air pollutants.
6. Following a procedure established and provided by the EPA WACOR, the contractor shall perform derivatization of polar organic compounds that enables quantitative resolution of such compounds via gas chromatography/mass spectrometry. Suitable standards shall also be derivatized by the contractor and used to (1) estimate deuterated standard recoveries (by making multiple GC/MS runs of the deuterated standards during a sample run sequence) and (2) to populate appropriate calibration database levels. Documentation of data quality for the derivatization steps shall be performed by the contractor. This data quality documentation shall be linked to specific PM extract samples analyzed by GC/MS. The contractor shall purchase derivatization equipment needed to conduct on-line or in-situ methylation and silylation experiments. Purchased equipment shall be compatible with the GC-MS technology and instrumentation available in the FPMCL and shall include an auto-sampler device.
7. The contractor shall perform canister analysis following established VOC laboratory analysis protocols to quantify ethylene oxide following all quality guidelines in EPA Method TO-15A for ambient, source emission and quality control samples. The contractor shall determine report ethylene oxide concentrations and provide indications of data quality as outlined in TO-15A and relevant QAPPs. The contractor shall search for and identify the presence of coeluting compounds that may interfere with the ethylene oxide analysis. The contractor shall follow all reporting guidelines for quantified compounds listed above in this section.
8. The contractor shall provide for appropriate handling and disposal of all laboratory waste solvents and other laboratory waste materials.
9. The contractor shall operate, maintain, and modify, as necessary, analytical instrumentation and ancillary equipment in the EPA FPMCL. Note: this Task includes ensuring appropriate instrument gases are provided (e.g., He, H<sub>2</sub>, N<sub>2</sub>, and air). The contractor shall maintain a file of operating manuals for all equipment and instruments. Equipment and instruments included in this Task are:

- (a) HP-7890/7000 Auto sampler/Gas Chromatograph/MSD (qqq) in Room E580-A
- (b) HP-6890/5793 Thermal extraction unit/2-dimensional Gas Chromatograph/MSD/ in E589-A
- (c) HP-6890/5793 VOC pre-concentrator (ENTECH Inc) Gas Chromatograph/MSD/ in E288
- (d) HPLC-MS (Q-TOF) and N2-generator in E589

- (e) Zymark TurboVap solvent concentrator in E580-A
  - (f) Cryofreezer in E580
  - (g) Fisher Isotemp muffle furnace in E569
  - (h) Skutt ceramic kiln in E578-A
  - (i) Nuaire horizontal clean bench in E578-A
  - (j) Sunset Thermal-Optical Elemental/Organic Carbon Analyzers in E-581-A and E589
  - (k) Thelco convection oven in E581-A
  - (l) Ainsworth semi-micro balance in E581-A or high-bay area
  - (m) Dionex 120 ion chromatograph in E581-A
  - (n) Sartorius MC5 microbalance in E580-A item Cahn ultra microbalance in E580-A
  - (o) Terra Universal modular clean room in E580-A
  - (p) Dracor water purification system in E581-A
  - (q) Frigidaire commercial freezer and additional cryo-freezer units in E578
  - (r) Dommic-Hunter hydrogen generators (2) in E581-A
  - (s) HP-6890/5793 Thermal extraction unit/Gas Chromatograph/MSD/FID in E580-A
10. The contractor shall maintain a complete and up-to-date chemical inventory for the FPMCL Facility along with Material Safety Data Sheets for all chemicals.
11. The contractor shall update, as needed, the Facility Manual for the PM2.5 Analytical Facility which includes as a minimum the following items:
- (a) General facility lay-out
  - (b) List of equipment by name, serial and model no, custodial account ID, EPA decal no., and location
  - (c) Computer software and hardware
  - (d) Safety/Health protocols
  - (e) Quality Assurance and Control protocols
  - (f) Sampling and Analysis Methods (ASTM, EPA, Miscellaneous Operating Procedures)
12. With the exception of the miscellaneous operating procedures (MOPs) for cleaning sample substrates, laboratory glassware, and sampling train components for which the Contractor shall be responsible, the QA/QC protocols, analytical protocols, and other MOPs will be provided by the EPA WACOR for incorporation into the Facility Manual. The Facility Manual is a working document and will incorporate new material as protocols are established or modified and additional equipment is acquired.
13. The contractor shall supply to the WACOR on a monthly basis a written progress report that includes: (1) a list by identification number of the samples analyzed; (2) the type of analysis done; (3) the results and data analysis; (4) a brief interpretation of the results; (5) future work planned in the laboratory; (6) proof of data quality; (7) description of experimental procedure used and any observed anomalous behavior; and (8) description of laboratory operations; The contractor shall also provide to the WACOR electronic copies of completed data sets and data analysis by source. In the event that the analysis of sample substrates from a single test source are completed, the contractor shall produce a written report describing the results of the analysis, the source sampling test conditions, and any other pertinent particle sizing and/or counting data.

## 5 INSTRUMENT AND EQUIPMENT EXPECTATIONS

In addition to the above, the contractor shall research the possibility of further automating the micro- solvent extraction, filtering, and concentration techniques. In consultation with the WACOR, the contractor shall purchase technology that improves the analytical sample throughput or speed at which these steps can be conducted. Additional sampling equipment shall also be purchased in the event there is a need to complete a project in a timely manner.

The contractor shall purchase analytical instrumentation most capable of performing whole air sample canister analysis of ethylene oxide at 10 ppt sensitivity meeting all of TO-15A guidelines. The analytical system shall include 1) canister autosamplers to automatically sample from at least 15 1.4 L and 15 6 L canisters, 2) a preconcentration system capable of trapping ethylene oxide and a wide range of other VOCs (C2-C12 volatility range), 3) a GC/MS with high sensitivity ion source for improved instrument sensitivity. Additional canisters compatible with TO-15A analysis of ethylene oxide shall also be purchased. **The contractor shall not order equipment without prior consultation with the WACOR.**



## **6     QUALITY ASSURANCE**

All PWS activities described in Section IV are covered by a quality assurance project plan (QAPP) developed within NRMRL. The QAPP is entitled: “Chemical analysis of fine particulate matter”. It is an EPA category B measurement plan and identified as QTRAK# 99002/III. The contractor shall abide by this QAPP.

## **7 LABOR MIX**

To achieve the objectives of the WA the following labor mix is required: (1) a person with extensive experience in chemical analysis using chromatography (GC-MS/FID, LC-MS, etc.). This individual shall have at least 20 years of GC-MS experience and be familiar with the extraction and pre-concentration procedures used for PM and miscellaneous organic gases. This individual shall be responsible for GC-MS (qqq) analysis and interpretation of GC-MS data as stated above. This person shall follow all the required QA/QC procedures established in any relevant QA protocols and shall be required to communicate results to the WACOR. This individual shall also be responsible for certain research pursuits as they relate to the analysis of GC-MS data, including library searches and the application of identified deconvolution algorithms. The contractor shall ultimately be responsible for the GC-MS data quality provided to the WACOR. (2) an individual who assists with extractions, sampling and media pretreatment and sample handling, and other similar logistical tasks shall occasionally be needed.

## **8 SCHEDULE OF DELIVERABLES**

The contractor shall deliver: (1) a report and data worksheet containing volatility basis set (VBS) and SVOC emission factor results from a West Virginia University dynamometer study investigating organic matter emitted from gasoline direct injection vehicles. The analysis shall be performed using TE-GC-MS and Carbotrap tubes (due on or before July 31, 2019); (2) a report detailing VBS and SVOC emission factor results for biomass burning tests (woodstoves and wildfires) performed at EPA facilities (due on or before October 31, 2019); (3) a report on SVOC emissions from cookstoves (due on or before March 31, 2020); (4) a report and data worksheet of ethylene oxide concentration results from samples collected during the Ethylene Oxide Field Evaluation Study (due on or before December 31, 2019); (5) submission of a purchase order for a new analytical ethylene oxide measurement system (due on or before August 31, 2019).

<b>EPA</b> United States Environmental Protection Agency Washington, DC 20460 <b>Work Assignment</b>						Work Assignment Number 4-006				
						<input type="checkbox"/> Other <input type="checkbox"/> Amendment Number:				
Contract Number EP-C-15-008			Contract Period   04/01/2015   To   03/31/2020 Base                      Option Period Number       4			Title of Work Assignment/SF Site Name See attached PWS				
Contractor JACOBS TECHNOLOGY INC.					Specify Section and paragraph of Contract SOW 1-4, 6					
Purpose: <input checked="" type="checkbox"/> Work Assignment <input type="checkbox"/> Work Assignment Close-Out <input type="checkbox"/> Work Assignment Amendment <input type="checkbox"/> Incremental Funding <input type="checkbox"/> Work Plan Approval					Period of Performance  From   04/01/2019   To   03/31/2020					
Comments: Work Plan due 5/9/19.  Work may begin immediately.										
<input type="checkbox"/> Superfund                      Accounting and Appropriations Data <input checked="" type="checkbox"/> Non-Superfund										
SFO <input type="checkbox"/> Note: To report additional accounting and appropriations date use EPA Form 1900-69A. (Max 2)										
Line	DCN (Max 6)	Budget/FY (Max 4)	Appropriation Code (Max 6)	Budget Org/Code (Max 7)	Program Element (Max 9)	Object Class (Max 4)	Amount (Dollars)	(Cents)	Site/Project (Max 8)	Cost Org/Code
1										
2										
3										
4										
5										
Authorized Work Assignment Ceiling										
Contract Period:                      Cost/Fee:                      LOF: 04/01/2015   To   03/31/2020										
This Action:   										
Total:										
Work Plan / Cost Estimate Approvals										
Contractor WP Dated:                      Cost/Fee                      LOE:										
Cumulative Approved:                      Cost/Fee                      LOE:										
Work Assignment Manager Name   Jim Jetter  <div style="display: flex; justify-content: space-between;"> <div>_____</div> <div>_____</div> </div> <div style="display: flex; justify-content: space-between;"> <div>(Signature)</div> <div>(Date)</div> </div>							Branch/Mail Code: Phone Number: 919-541-4830 FAX Number:			
Project Officer Name   Robin S. Harris  <div style="display: flex; justify-content: space-between;"> <div>_____</div> <div>_____</div> </div> <div style="display: flex; justify-content: space-between;"> <div>(Signature)</div> <div>(Date)</div> </div>							Branch/Mail Code: Phone Number: 919-541-0955 FAX Number:			
Other Agency Official Name  <div style="display: flex; justify-content: space-between;"> <div>_____</div> <div>_____</div> </div> <div style="display: flex; justify-content: space-between;"> <div>(Signature)</div> <div>(Date)</div> </div>							Branch/Mail Code: Phone Number: FAX Number:			
Contracting Official Name   Keith Pfeffer  <div style="display: flex; justify-content: space-between;"> <div>_____</div> <div>_____</div> </div> <div style="display: flex; justify-content: space-between;"> <div>(Signature)</div> <div>(Date)</div> </div>							Branch/Mail Code: Phone Number: FAX Number:			

## **Performance Work Statement**

WA Title: Cookstove Emissions and Fuel Efficiency Research

WA #: 4-006

WACOR: Jim Jetter

Contract #: EP-C-15-008

Alternate WACOR: Jacky Rosati Rowe

### **PERIOD OF PERFORMANCE**

The period of performance detailed in this Performance Work Statement (PWS) shall be from work assignment issuance through March 31, 2020.

NOTE: This work assignment is a continuation of work performed in Option Period 3 under Work Assignment # 3-006.

### **SUMMARY OF OBJECTIVES**

The primary objective of this work assignment (WA) is to measure energy efficiency and air pollutant emissions from practical, fuel-efficient, “cleaner-burning” cookstoves. Pollutant emissions from “cleaner-burning” solid-fuel stoves shall be compared to emissions from the traditional “three-stone” fire, as well as to emissions from liquid- and gas-fueled stoves. This study provides stove emissions information that will be valuable to Clean Cooking Alliance (the Alliance) partners disseminating stove technology in the field. Additionally, this study is exploring how cookstove performance and emissions are affected by conditions including fuel moisture content, fuel size and shape, operator technique, weather conditions, pot size and shape, and stove durability. Results from this study will support the development of testing protocols and standards through ISO Technical Committee 285, Clean Cookstoves and Clean Cooking Solutions. This work also provides technical support for the development of Regional Testing and Knowledge Centers, many of which are sponsored by the Alliance. Stoves to be tested are identified below.

### **BACKGROUND**

This work is part of EPA’s commitment in support of the Clean Cooking Alliance. The Alliance was launched after ten years of foundational work conducted by the EPA-led Partnership for Clean Indoor Air (now integrated with the Alliance). The Alliance is a public-private partnership that seeks to save lives, improve livelihoods, empower women, and protect the environment by creating a thriving global market for clean and efficient household cooking solutions. Its goal is to foster the adoption of clean cookstoves and fuels in 100 million households by 2020. For more information, see the Alliance web site at: <http://www.cleancookstoves.org/>

The WHO (World Health Organization) estimates that household air pollution mainly from solid-fuel cookstoves causes 3 to 4 million premature deaths annually – greater than the combined impact of HIV, malaria, and tuberculosis globally. Cookstove emissions of black carbon, brown carbon, organic carbon, CO<sub>2</sub>, and methane also affect global climate change.

Reducing household air pollution associated with burning solid fuels provides multiple benefits. Human health is improved through better indoor air quality and ambient air quality. Sustainability and ecology are promoted through reduced deforestation and protection of biodiversity. Global climate change is addressed through reduced emissions of greenhouse gases and other climate forcers. International relations are improved through collaboration with partners.

## SCOPE

The scope of this WA includes operation of research facilities, testing of stoves and fuels, gravimetric filter sample analysis, data processing and analysis, and other activities, as described in detail below.

## TECHNICAL APPROACH /OBJECTIVES

Operation of research facilities. The contractor shall operate an existing cookstove test facility in the EPA High Bay Building (Room H-106). This system has capabilities for testing stoves with tall chimneys and for measuring emissions at various dilution ratios. The contractor shall operate, maintain, and repair the facilities, as needed. EPA will provide instrumentation. The contractor shall provide continuous improvement of the system, as needed, to meet QA requirements, improve efficiency of operations, and improve general quality.

Testing of stoves and fuels. The EPA WACOR will obtain the stoves and will specify which stoves shall be tested. The Contractor shall operate the stoves during the testing. This work is a continuation of the project under WA 3-006, and stoves to be tested shall include the following types:

- Five stoves tested experimentally to support development of international protocols and standards through ISO Technical Committee 285 – Clean Cookstoves and Clean Cooking Solutions
- Four stoves tested experimentally to support EPA Region 9 – Navajo Nation stove change-out program. Performance shall be compared between a baseline traditional coal/wood stoves and newly developed EPA-certified coal/wood stoves.
- Pellet-fuel stoves tested in support of research project initiated by ORISE Postdoctoral Fellow, Guofeng Chen, and continued by ORISE Postdoc, Wyatt Champion.
  - Stoves:
    - Mimi Moto: 3 test phases (high-, medium-, and low-power)
    - Philips Fan: 3 test phases (high-, medium-, and low-power)
    - Xunda Stove: 1 test phase (one power level)
  - Fuels:
    - Wood pellets
    - Wood sticks
    - Agriculture waste pellets

Total number of stove/fuel combinations to be tested: 12 total, with completion of approximately 2 per month.

Fuels to be tested. Wood-burning stoves shall be tested with high- and low-moisture hardwood, red oak, fuel. Freshly cut “green” red oak firewood without bark, lengths approximately 14”, shall be obtained from a local vendor. The wood shall be cut on a table saw and/or band saw to produce sticks that shall be approximately 2 cm x 2 cm in cross section. Half of the fuel wood shall be air dried to a moisture content of approximately 10 percent (on a wet basis), and the other half of the fuel wood shall be stored in air-tight barrels in a freezer to keep the moisture content at approximately 30 percent.

Charcoal-fueled stoves shall be tested with “lump” charcoal (not compressed briquettes) similar to that available in developing countries. Stoves shall be tested with “dry” charcoal (approximately 5 percent moisture content on a wet basis). Charcoal stoves shall be tested following guidelines available from the Clean Cooking Alliance web site:  
<http://cleancookstoves.org/binary-data/DOCUMENT/file/000/000/401-1.pdf>

All fuels shall be analyzed for moisture content using ASTM Standard Method D4442-07. Moisture content of the fuels shall be measured on each day of testing. A random sample of fuel wood, with a mass of approximately 100 g, shall be weighed with an electronic balance. The sample shall be dried in a ventilated oven for at least 8 hours, and then the sample shall be weighed periodically until no mass change is detected. The percent moisture content in the wood on a percent wet basis shall be calculated and recorded.

All fuels shall be analyzed for heat of combustion using ASTM Standard Method ASTM D5865-04. This testing shall be done by a qualified outside laboratory.

Air pollutants to be measured. The contractor shall measure emissions of the following pollutants for each stove and fuel combination:

- CO<sub>2</sub> - real-time, CEM (IR)
- CO - real-time, CEM (IR)
- PM<sub>2.5</sub>, measured gravimetrically, filter sample taken during each of the three phases of the WBT (Water Boiling Test – see below)
- BC (black carbon) – real-time with aethalometer
- EC (elemental carbon) and OC (organic carbon) – quartz filter sample taken during each of the three phases of the WBT and analyzed with the thermal-optical method. Quartz “back-up” filter sample also taken during each WBT phase to quantify the gas-phase artefact
- PM, sub-micrometer particles measured with TSI EEPS (Engine Exhaust Particle Sizer Spectrometer)
- THC (total hydrocarbon) - real time, FID total HC analyzer
- CH<sub>4</sub> (methane) - real time, FID analyzer
- Other pollutants may be added if resources (instruments and personnel) are available

The EPA will furnish instrumentation and equipment necessary to measure air pollutants.

BC/EC/OC analysis will be provided by EPA Emissions Characterization and Prevention Branch, contact: Michael Hays

Test protocols. ISO (International Organization for Standardization) Standard 19867-1: 2018, Standard test sequence for emissions and performance available at:  
<https://www.iso.org/standard/66519.html>

WBT (Water Boiling Test) Version 4.2.3 available at:  
<http://cleancookstoves.org/technology-and-fuels/testing/protocols.html>

A summary of the WBT performance test protocol follows:

“This modified version of the well-known Water Boiling Test (WBT) is a simulation of the cooking process that can be performed on most stoves in use throughout the world. While the test is not intended to replace other forms of stove assessment, it is designed to be a simple method by which stoves made in different places and for different cooking applications may be compared by a standardized and replicable protocol.”

“The WBT ... consists of three phases.

- 1) In the first phase, the tester begins with the stove at room temperature and uses a pre-weighed bundle of wood to boil a measured quantity of water in a standard pot. The tester then replaces the boiled water with a fresh pot of cold water to perform the second phase of the test.
- 2) In the second phase, water is boiled beginning with a hot stove in order to identify differences in performance between a stove when it is cold and when it is hot.
- 3) Lastly, the tester again boils a measured amount of water and then, using a pre-weighed bundle of wood, simmers the water at just below boiling for a measured period of time (45 minutes). The third step simulates the long cooking of legumes or pulses that is common throughout much of the world.”

“This combination of tests is intended to measure the stove’s performance at both high and low power outputs, which are important indicators of the stove’s ability to conserve fuel.”

Gravimetric filter sample analysis. The contractor shall perform gravimetric filter analysis for PM<sub>2.5</sub> using EPA facilities in Room E-487. The contractor shall perform manual or robotic weighing of the filters.

Data analysis. The contractor shall provide support for processing and analyzing data from the cookstove tests conducted under this WA. The contractor shall work closely with the EPA WACOR. The contractor shall use DASyLab software for data acquisition and Microsoft Excel spreadsheets for processing data. Microsoft Access may be used in the future for managing data. The contractor-provided support shall include QA checks of manual data entry, importing raw data into “daily data” spreadsheets, importing processed data from “daily data” spreadsheets into “stove/fuel spreadsheets,” evaluating carbon balance calculations, and final QA checks. The contractor shall identify tests that do not meet QA requirements, and repeat tests if necessary. This work shall be described in a QAPP (Quality Assurance Project Plan) and associated MOPs (see below). The work shall be coordinated with the EPA WACOR, and the EPA WACOR will provide further details.

The contractor shall use the automated system that has been developed to enable immediate data processing following each stove test (not including analysis of samples that require post-processing, e.g., filter samples).

ISO 17025 accreditation. The EPA WACOR is pursuing ISO 17025 accreditation. The contractor shall provide technical support throughout the process that includes a gap analysis, conformance assessment, and proficiency tests. Further details will be provided by the EPA WACOR.

Results. The contractor shall deliver data to the EPA WACOR in Microsoft Excel files that can be easily analyzed. Results shall be reported as averages and standard deviations for the replicate tests for each stove. The contractor shall report data including all parameters in the WBT test protocol, and the data shall be in a format similar to that used in previous testing.

## SAFETY

The Contractor shall comply with a Health and Safety Protocol. The Contractor shall maintain a safe working environment during testing.

## QUALITY ASSURANCE

An existing QAPP (QT 06037/A12459 – Category A) shall be followed for this work assignment. Internal technical systems audits have previously been completed, and the project was approved by an EPA internal quality assurance review. An internal audit of data quality was also previously performed. If any revision of the QAPP (and associated MOPs) is required, the QAPP shall be reviewed and approved by the contractor's work assignment leader and QA officer. Once it has obtained their approval, it shall be submitted to the EPA QA staff for review and approval. It shall be accompanied by a signature page that is signed by the contractor's work assignment leader and QA officer to show that they have reviewed and approved the revised QAPP. The contractor's work assignment leader shall document this process. Upon receipt of the signed QAPP, the EPA WACOR and QA manager will review and approve the QAPP and they will add their signatures to the signature page. Any work involving environmental data shall not commence until the QAPP has received official approval from the EPA QA staff.

See: ATTACHMENT #1 to this PWS.

## DELIVERABLES

The Contractor shall prepare and deliver brief, monthly progress reports in accordance with the reporting requirements in the contract. The contractor shall deliver data and filter samples to the EPA WACOR. The final report will be prepared by the EPA WACOR and will be in the form of EPA reports and/or manuscripts to be submitted to peer-reviewed journals for publication. Contractor personnel may be coauthors of the publications.



## SCHEDULE OF DELIVERABLES

Raw test data, filter samples, and processed data shall be deliverables.

Schedule is as follows:

January 31, 2020	Complete cookstove testing
February 28, 2020	Deliver all filter samples and raw test data
March 31, 2020	Complete data analysis and quality assurance, and deliver all processed data

## ATTACHMENT #1 TO THE PWS FOR QA CATEGORY A PROJECTS

### NRMRL QA Requirements and Definitions

In accordance with EPA Order 5360.1 A2, conformance to ANSI/ASQC E4 must be demonstrated by submitting the quality documentation described herein. All quality documentation shall be submitted to the Government for review. The Government will review and return the quality documentation, with comments, and indicate approval or disapproval. If the quality documentation is not approved, it must be revised to address all comments and shall be resubmitted to the Government for approval. Work involving environmental data collection, generation, use, or reporting shall not commence until the Government has approved the quality documentation. The QAPP shall be submitted to the Government at least thirty (30) days prior to the beginning of any environmental data gathering or generation activity in order to allow sufficient time for review and revisions to be completed. After the Government has approved the quality documentation, the Contractor shall also implement it as written and approved by the Government.

#### **Definitions:**

**Environmental Data** - These are any measurements or information that describe environmental processes, location, or conditions; ecological or health effects and consequences; or the performance of environmental technology. For EPA, environmental data include information collected directly from measurements, produced from software and models, and compiled from other sources such as data bases or the literature.

**Quality Assurance (QA)** - Quality assurance is a system of management activities to ensure that a process, item, or service is of the type and quality needed by the customer. It deals with setting policy and running an administrative system of management controls that cover planning, implementation, and review of data collection activities and the use of data in decision making. Quality assurance is just one part of a quality system.

**Quality Assurance Project Plan (QAPP)** - A QAPP is a document that describes the necessary quality assurance, quality control, and other technical activities that must be implemented to ensure that the results of the work performed will satisfy the stated performance criteria. A QAPP documents project-specific information.

**Quality Control (QC)** - Quality control is a technical function that includes all the scientific precautions, such as calibrations and duplications, that are needed to acquire data of known and adequate quality.

**Quality Management Plan (QMP)** - A QMP is a document that describes an organization's/program's quality system in terms of the organizational structure, policy and procedures, functional responsibilities of management and staff, lines of authority, and required interfaces for those planning, implementing, documenting, and assessing all activities conducted. A QMP documents the overall organization/program, and is primarily applicable to multi-year, multi-project efforts. An organization's/program's QMP shall address all elements listed in the ARequirements for Quality Management Plans@ in Appendix B of the NRMRL QMP.

**Quality System** - A quality system is the means by which an organization manages its quality aspects in a systematic, organized manner and provides a framework for planning, implementing, and assessing work performed by an organization and for carrying out required quality assurance and quality control activities.

**R-2** - EPA Requirements for Quality Management Plans (EPA/240/B-01/002) March, 2001,  
<http://www.epa.gov/quality/qs-docs/r2-final.pdf>

**R-5** - EPA Requirements for QA Project Plans (EPA/240/B-01/003) March, 2001  
<http://www.epa.gov/quality/qs-docs/r5-final.pdf>

**Substantive Change** - Substantive change is any change in an activity that may alter the quality of data being used, generated, or gathered.

**EPA=s Quality System Website:** <http://www.epa.gov/quality/>

**EPA=s Requirements and Guidance Documents:** [http://www.epa.gov/quality/qa\\_docs.html](http://www.epa.gov/quality/qa_docs.html)

**□ NRMRL=s Quality System Specifications:**

- (1) a description of the organization=s Quality System (QS) and information regarding how this QS is documented, communicated and implemented;
- (2) an organizational chart showing the position of the QA function;
- (3) delineation of the authority and responsibilities of the QA function;
- (4) the background and experience of the QA personnel who will be assigned to the project; and
- (5) the organization=s general approach for accomplishing the QA specifications in the SOW.

**Category Level Designations (determines the level of QA required):**

- X Category A Project** - applicable to studies performed to generate data used in support of the development of environmental regulations or standards. The QAPP shall address all elements listed in R-5.
- Category B Project** - applicable to projects involving applied research or technology evaluations. The QAPP shall address the applicable sections of R-5, as outlined in the NRMRL QAPP requirements for the specific project type.

**Suggested Content for Required Elements of QA Project Plans as per R-5:**

**GROUP A PROJECT MANAGEMENT**

There are nine elements in this group. These address project administrative functions and project concerns, goal(s), and approach(es) to be followed.

**Element A1- Title and Approval Sheet**

- Project title
- Organization name
- Names, titles, signatures, and signature dates of the approving officials

**Element A2- Table of Contents**

- Table of Contents;
- List of Figures, Tables, References and Appendices
- Document control format

**Element A3- Distribution List**

Names of individuals and organization(s) to receive a copy of the approved QA Project Plan

**Element A4- Project/Task Organization**

- List of individuals and organizations involved with the project, identifying their roles and responsibilities
- Documentation of project QA Manager's independence

- Identification of the individual responsible for maintaining the official, approved QA Project Plan
- Organizational chart showing relationships and lines of communication among project personnel

#### **Element A5- Problem Definition/Background**

- Statement of specific problem to be solved, decision to be made, or outcome to be achieved
- Background information

#### **Element A6- Project/Task Description**

- Summary of work to be performed and products
- Project schedule
- Maps, tables, etc. showing geographic locations

#### **Element A7- Quality Objectives and Criteria**

- Outputs from the systematic planning process (e.g., DQOs) used to design the study
- Measurement performance or acceptance criteria established as part of the study design. These relate the quality of data needed to the established limits on the chance of making a decision error or of incorrectly answering a study question

#### **Element A8- Special Training/Certifications**

- Description of how the most current approved QA Project Plan will be distributed to project staff
- List of records to be included in the data report package
- List of any other project documents to be produced
- Information on the final disposition of records and documents, including location and retention schedule

#### **Element A9- Documentation and Records**

- Any specialized training or certifications needed by personnel
- Plans for providing, documenting, and assuring this training

### **GROUP B: DATA GENERATION AND ACQUISITION**

The ten elements in this group address data generation and data acquisition and management activities.

#### **Element B1- Sampling Process Design (Experimental Design)**

Description of project's experimental design

#### **Element B2- Sampling Methods**

- Description of sample/data collection procedures
- List of equipment needed
- Identification of performance requirements
- Description of corrective actions to be taken if problems arise

#### **Element B3- Sample Handling and Custody**

Description of sample handling requirements and transfer, and for ultimate disposal

#### **Element B4- Analytical Methods**

- Description of analytical methods to be used

- Identification of any performance criteria
- Description of corrective actions when problems arise

#### **Element B5- Quality Control**

- List of QC activities needed for sampling, analytical, or measurement techniques, along with their frequency
- Description of control limits for each QC activity and corrective actions when these are exceeded
- Identification of any applicable statistics to be used

#### **Element B6- Instrument/Equipment Testing, Inspection, and Maintenance**

- List of equipment and/or systems needing periodic maintenance, testing, or inspection, and the schedule for such
- Description of how inspections and periodic preventive maintenance procedures will be performed and documented
- Discussion on how critical spare parts will be supplied and stocked
- Description of how re-inspections will be performed and effectiveness of corrective actions determined and documented

#### **Element B7- Instrument/Equipment Calibration and Frequency**

- List of all project tools, gauges, instruments, and other sampling, measuring, and test equipment which should be calibrated
- Description of calibration method and identification of any certified equipment and/or standards to be used
- Details of how calibration records will be maintained and traceable to the instrument/equipment

#### **Element B8- Inspection/Acceptance of Supplies and Consumables**

- A list of project supplies and consumables that may directly or indirectly affect the quality of the results
- The acceptance criteria for them
- Identification of those responsible

#### **Element B9- Non-direct Measurements**

- Identification of any existing data that will be obtained from non-measurement sources, such as literature files and historical databases
- Description of how you intend to use the data
- Your acceptance criteria and any limitations for using such data

#### **Element B10- Data Management**

- Description of the project data management process
- Description of or reference to the office's standard record-keeping procedures and document control, data storage, retrieval, and security systems
- Identification of data handling equipment and procedures to process, compile, and analyze project data
- Discussion of data handling procedures to detect and correct errors and loss during data processing
- Examples of any forms or checklists to be used
- Identification of any specific computer hardware/software performance requirements and how configuration acceptability will be determined
- Description of how applicable information resource management requirements will be satisfied, as well as any applicable Agency information resource management requirements (EPA Directive 2100,

## **GROUP C: ASSESSMENT AND OVERSIGHT**

Assessments or evaluations are designed to determine whether the QA Project Plan is being implemented as approved (conformance/nonconformance), to increase confidence in the information obtained, and ultimately to determine whether the information may be used for their intended purpose. The two elements in this group detail what assessments or evaluations will occur both during and after the project. Data assessments, such as data verification and validation, are discussed in the Group D elements.

### **Element C1- Assessments and Response Actions**

- Description of project assessments planned and a brief discussion of the information expected
- Approximate schedule for these assessments and their reports
- For any planned self-assessments, identification of potential participants and their relationship within the project organization
- For independent assessments, identification of the organization and person(s) that will conduct the assessments
- Identification of how, when, and to whom the results of each assessment will be reported and corrective actions implemented

### **Element C2- Reports to Management**

- Frequency and distribution of reports to inform management (EPA or otherwise) of the project's status
- Identification of report preparer and recipients, as well as any specific actions or recommendations recipients are expected to make

## **GROUP D: DATA VALIDATION AND USABILITY**

The three elements in this group address the final project checks to see if the data or product obtained will conform to the project's objectives, and to estimate the effect of any deviations. For projects that use existing data, these elements focus on evaluating how data values from these acquired data sets will be used to determine the quality objectives for the new data use. For a modeling project, this process is similar to confirming that the steps in the modeling process were followed correctly to produce the model outputs and that the results meet project objectives.

### **Element D1- Data Review, Verification, and Validation**

State the criteria for deciding to accept, reject, or qualify project data in an objective and consistent manner

### **Element D2- Verification and Validation Methods**

- Description of how project data will be verified and validated
- Discussion of how any issues will be resolved and identification of who has the authority for resolving them
- Description of how results will be conveyed to data users
- Explanation of how validation issues differ from verification issues for this project
- Examples of any forms or checklists to be used and identification of any project-specific calculations

### **Element D3- Reconciliation with User Requirements**

- Description of how project results will be reconciled with the requirements defined by the data user or decision maker
- An outline of methods proposed to analyze the data and determine possible anomalies or departures

- from assumptions made when the project was planned
- Description of how reconciliation with user requirements will be documented, issues will be resolved, and how limitations on the use of the data will be reported to decision makers



<b>EPA</b> United States Environmental Protection Agency Washington, DC 20460 <b>Work Assignment</b>						Work Assignment Number 4-007				
						<input type="checkbox"/> Other <input type="checkbox"/> Amendment Number:				
Contract Number EP-C-15-008			Contract Period   04/01/2015   To   03/31/2020 Base                      Option Period Number       4			Title of Work Assignment/SF Site Name See attached PWS				
Contractor JACOBS TECHNOLOGY INC.						Specify Section and paragraph of Contract SOW Section 1, 2, 3 and 5				
Purpose: <input checked="" type="checkbox"/> Work Assignment <input type="checkbox"/> Work Assignment Close-Out <input type="checkbox"/> Work Assignment Amendment <input type="checkbox"/> Incremental Funding <input type="checkbox"/> Work Plan Approval						Period of Performance  From   04/01/2019   To   03/31/2020				
Comments: Work Plan due 4/29/19.  No work, including but not limited to preparation of the Work Plan, shall begin until 4/1/19.										
<input type="checkbox"/> Superfund						Accounting and Appropriations Data				<input checked="" type="checkbox"/> Non-Superfund
SFO <input type="checkbox"/> Note: To report additional accounting and appropriations date use EPA Form 1900-69A. (Max 2)										
Line	DCN (Max 6)	Budget/FY (Max 4)	Appropriation Code (Max 6)	Budget Org/Code (Max 7)	Program Element (Max 9)	Object Class (Max 4)	Amount (Dollars)	(Cents)	Site/Project (Max 8)	Cost Org/Code
1										
2										
3										
4										
5										
Authorized Work Assignment Ceiling										
Contract Period:                      Cost/Fee:                      LOF: 04/01/2015   To   03/31/2020										
This Action:   										
Total:										
Work Plan / Cost Estimate Approvals										
Contractor WP Dated:                      Cost/Fee                      LOE:										
Cumulative Approved:                      Cost/Fee                      LOE:										
Work Assignment Manager Name   Susan Thorneloe  <div style="display: flex; justify-content: space-between;"> <div>_____</div> <div>_____</div> </div> <div style="display: flex; justify-content: space-between;"> <div>(Signature)</div> <div>(Date)</div> </div>							Branch/Mail Code: Phone Number: 919-541-2709 FAX Number:			
Project Officer Name   Robin S. Harris  <div style="display: flex; justify-content: space-between;"> <div>_____</div> <div>_____</div> </div> <div style="display: flex; justify-content: space-between;"> <div>(Signature)</div> <div>(Date)</div> </div>							Branch/Mail Code: Phone Number: 919-541-0955 FAX Number:			
Other Agency Official Name  <div style="display: flex; justify-content: space-between;"> <div>_____</div> <div>_____</div> </div> <div style="display: flex; justify-content: space-between;"> <div>(Signature)</div> <div>(Date)</div> </div>							Branch/Mail Code: Phone Number: FAX Number:			
Contracting Official Name   Keith Pfeffer  <div style="display: flex; justify-content: space-between;"> <div>_____</div> <div>_____</div> </div> <div style="display: flex; justify-content: space-between;"> <div>(Signature)</div> <div>(Date)</div> </div>							Branch/Mail Code: Phone Number: FAX Number:			

## **Performance Work Statement**

WA Title: LEAF Methods Development and Implementation

WA #: 4-007

WACOR: S. Thorneloe

Contract #: EP-C-15-008

Alternate WACOR: E. Thoma

### **PERIOD OF PERFORMANCE**

The period of performance detailed in this Performance Work Statement (PWS) shall be from April 1, 2019 through March 31, 2020.

### **SUMMARY OF OBJECTIVES**

- (1) Provide technical support in addressing comments on the Leaching Environmental Assessment Framework (LEAF) Implementation guidance, webinar, and training materials
- (2) Update LeachXS-Lite and prepare for review and release of updated software
- (3) Series of manuscripts to illustrate case studies and use of LEAF including use of geochemical speciation modeling to consider redox, carbonation, and other factors not easily reflected as part of a commercial laboratory assessment.
- (4) Respond to questions on background information document on organics developed under work assignment 3-041; complete for publication
- (5) Demonstrate LEAF organics methods and document in a report for up to three different materials.

### **BACKGROUND**

Work began in previous work assignments to develop implementation guidance for use of LEAF for evaluating partitioning of pollutants from solid to liquid phase. This is particularly important for air pollution control residues where air pollutants such as Hg are captured through air pollution control and the resulting residue (referred to as coal combustion residues) is managed through “beneficial use”, treatment, or discarded in a landfill. The major output in 2018 was the LEAF How to Guide addressing public review comments and adding in additional case studies based on the two manuscripts illustrating both screening and scenario assessments.

LeachXS-Lite has been in use for management, visualization, and documentation for source term derivation. We will need to prepare it for review and to meet EPA criteria for use of the software as part of environmental assessments. Will work with EPA Office of Science and Information Management to determine what documents are needed for Vanderbilt’s hosting the software if that is determined appropriate link to the tool.

The work on use of bromine upstream of coal fired in a boiler will be documented as part of a series of manuscripts to help document geochemical speciation modeling and other work to develop source terms across a range of materials and management scenarios. The manuscripts will help get information into the hands of LEAF users quicker than developing reports. Finally,

as part of LEAF deployment, we will develop video and other materials in collaboration with OLEM to providing training for LEAF implementation (<https://clu-in.org/>).

## SCOPE

1. **Development/Modification/Compliance with QAPP:** The contractor shall develop quality assurance documentation as required in Appendices #1, 2, and 3 to this PWS. Any work involving environmental data shall not commence until the quality assurance documentation has received official approval from the EPA Quality Assurance Staff. The contractor shall comply with all requirements as delineated on the "Quality Assurance Review Form" included with this extramural activity.

There is an existing QAPP for this research (Q-TRAK # 030117-QP-1-0/QT16023) which was updated and approved in November 2018. The QAPP shall be reviewed and updated as needed including the addendum that was completed last fall for the materials compatibility evaluation.

2. **Review, Revise, and Post - LeachXS Lite.** Last work assignment, LeachXS-Lite was updated. However, it has not yet gone through review which shall be completed during this Option Period. The review shall provide comments from EPA and stakeholder review as required for EPA software projects. The software shall be posted at the same website that it has been hosted to date. The Contractor shall also provide the documentation for EPA software and data management projects for necessary approvals for software projects.

The Contractor shall include additional material datasets and information requested from users of the tool and collected by the EPA WACOR. This includes updating input templates, adding embedded tutorials, and screening assessment scenarios that provide a source term for use in OSWER's Industrial Waste Management Evaluation Model (IWEM) [<http://www.epa.gov/osw/nonhaz/industrial/tools/iwem/>] or other ground water transport and fate models. The Contractor shall make changes to LeachXS-Lite as needed based on EPA review of the software meeting the requirements for EPA software products.

3. **Series of manuscripts to help provide more timely information for use of LEAF.** In the last work assignment, two manuscripts were prepared that are ready for inclusion into STICs and submittal to journal for publication. During this Option Period, the contractor shall complete the publication of these manuscripts. The contractor shall also complete manuscript for bromine analysis and for geochemical speciation modeling. Part of this effort shall be to prioritize manuscript preparation with the input from the WACOR.
4. The Contractor shall develop materials for developing three webinars for training on LEAF in support of the program office's release of LEAF and implementation guidance. The contractor shall work with the WACOR in defining the materials including a brief overview of LEAF, demonstration of the individual methods, and overview of the supporting software (referred to as LeachXS-Lite).

5. The Contractor shall make changes to the background information document developed under work assignment WA 3-007 based on comments from the WACOR and stakeholder review.
6. The Contractor shall develop a draft report that documents the demonstration of LEAF for organics using three different waste or materials that were collected under work assignment 3-041. The Contractor shall provide an outline of the report within 5 months of WA effective date (4/1/19). The draft report shall be completed within the performance period of this work assignment.

### **Schedule of Deliverables**

Task 1 - Updated QAPPS as needed

Task 2 – By no later than 3/31/2020

Task 3 – By no later than 3/31/2020

Task 4 – By no later than 3/31/2020

Task 5 – By no later than 3/31/2020

Task 6 – By no later than 9/1/2019

Draft report – By no later than 3/31/2020

**ATTACHMENT #1 TO THE PWS  
FOR SECONDARY DATA PROJECTS**

**NRMRL Quality Assurance (QA) Requirements**

In accordance with EPA Order 5360.1 A2, conformance to ANSI/ASQC E4 must be demonstrated by submitting the quality documentation specified herein. All quality documentation shall be submitted to the Government for review. The Government will review and return the quality documentation, with comments, and indicate approval or disapproval. If the quality documentation is not approved, it must be revised to address all comments and shall be resubmitted to the Government for approval. Work involving environmental data collection, generation, use, or reporting shall not commence until the Government has approved the quality documentation. The quality documentation shall be submitted to the Government at least thirty (30) days prior to the beginning of any environmental data gathering or generation activity in order to allow sufficient time for review and revisions to be completed. After the Government has approved the quality documentation, the Contractor shall also implement it as written and approved by the Government. Any EPA-funded project/program may be subject to a QA audit.

**TO BE SUBMITTED PRE-AWARD (mark all that apply):**

☐ **NRMRL's Quality System Specifications:**

- (1) a description of the organization's Quality System (QS) and information regarding how this QS is documented, communicated and implemented;
- (2) an organizational chart showing the position of the QA function;
- (3) delineation of the authority and responsibilities of the QA function;
- (4) the background and experience of the QA personnel who will be assigned to the project; and
- (5) the organization's general approach for accomplishing the QA specifications in the SOW.

- ☐ **Quality Management Plan:** prepared in accordance with R-2 - EPA Requirements for Quality Management Plans (EPA/240/B-01/002) March, 2001,  
<http://www.epa.gov/quality/qs-docs/r2-final.pdf>

**TO BE SUBMITTED POST-AWARD (mark all that apply):**

☐ **NRMRL's Quality System Specifications:**

- (1) a description of the organization's Quality System (QS) and information regarding how this QS is documented, communicated and implemented;
- (2) an organizational chart showing the position of the QA function; 07/14/08 A-2
- (3) delineation of the authority and responsibilities of the QA function;
- (4) the background and experience of the QA personnel who will be assigned to the project; and
- (5) the organization's general approach for accomplishing the QA specifications in the SOW.

☐ **Quality Management Plan:** prepared in accordance with R-2 - EPA Requirements for Quality Management Plans (EPA/240/B-01/002) March, 2001,

<http://www.epa.gov/quality/qs-docs/r2-final.pdf>

☐ **Category I or II Quality Assurance Project Plan (QAPP):** prepared in accordance with R-5 - EPA Requirements for QA Project Plans (EPA/240/B-01/003) March, 2001

<http://www.epa.gov/quality/qs-docs/r5-final.pdf>

☒ **Category III or IV QAPP:** prepared in accordance with applicable sections of the following NRMRL QAPP Requirements List(s) which is(are) included in this attachment:

☐ **QAPP Requirements for Measurement Projects**

☒ **QAPP Requirements for Secondary Data Projects**

☐ **QAPP Requirements for Research Model Development and/or Application Projects**

☐ **QAPP Requirements for Software Development Projects**

☐ **QAPP Requirements for Method Development Projects**

- **QAPP Requirements for Design, Construction, and/or Operation of Environmental Technology Projects**

#### **ADDITIONAL QA RESOURCES:**

EPA's Quality System Website: <http://www.epa.gov/quality/>

EPA's Requirements and Guidance Documents: [http://www.epa.gov/quality/qa\\_docs.html](http://www.epa.gov/quality/qa_docs.html)

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### **NRMRL QAPP REQUIREMENTS FOR SECONDARY DATA PROJECTS**

#### **GENERAL REQUIREMENTS**

Include cover page, distribution list, approvals, and page numbers.

#### **0. COVER PAGE**

Include the Division/Branch, project title, revision number, EPA technical lead, QA category, organization responsible for QAPP preparation, and date.

#### **1. PROJECT DESCRIPTION AND OBJECTIVES**

1.1 Describe the process and/or environmental system to be evaluated.

1.2 State the purpose of the project and list specific project objective(s).

#### **2. ORGANIZATION AND RESPONSIBILITIES**

2.1 Identify all project personnel, including QA, and related responsibilities for each participating organization, as well as their relationship to other project participants.



2.2 Include a project schedule that includes key milestones.

### **3. SCIENTIFIC APPROACH**

3.1 Identify the secondary data needed to meet the project objective(s). Specify requirements relating to the type of data, the age of data, geographical representation, temporal representation, and technological representation, as applicable.

3.2 Identify the source(s) for the secondary data. Discuss the rationale for selecting the source(s) identified. If a hierarchy of sources exists for the gathering of secondary data, specify that hierarchy.

### **4. QUALITY METRICS**

4.1 Specify the quality requirements of the secondary data. These requirements must be appropriate for the intended use of the data. Address accuracy, precision, representativeness, completeness, and comparability, if applicable.

4.2 Describe the procedures for determining the quality of the secondary data.

4.3 If no project-specific data quality requirements exist, state this in the QAPP. If the quality of the secondary data will not be evaluated by EPA, require that a disclaimer be added to any project deliverable to indicate that the quality of the secondary data has not been evaluated by EPA for this

specific application. Provide the wording for the disclaimer.

### **5. DATA ANALYSIS, INTERPRETATION, AND MANAGEMENT**

5.1 Identify the data reporting requirements, including data reduction procedures specific to the project and applicable calculations and equations.

5.2 Describe data validation procedures used to ensure the reporting of accurate project data.

5.3 Describe how the data will be summarized or analyzed (e.g., qualitative analysis, descriptive or inferential statistics) to meet the project objective(s).

5.3.1- If descriptive statistics are proposed, state what tables, plots, and/or statistics (e.g., mean, median, standard error, minimum and maximum values) will be used to summarize the data.

5.3.2- If an inferential method is proposed, indicate whether the method will be a hypothesis test, confidence interval, or confidence limit and describe how the method will be performed.

5.4 Describe data storage requirements for both hard copy and electronic data.

## **6. REPORTING**

6.1 List and describe the deliverables expected from each project participant.

6.2 Specify the expected final product(s) that will be prepared for the project (e.g., journal article, final report, etc.). Specify the source(s) of the secondary data in any deliverable.

## **7. REFERENCES**

Provide references either in the body of the text as footnotes or in a separate section.

**ATTACHMENT #2 TO THE PWS  
FOR SOFTWARE DEVELOPMENT PROJECTS**

**NRMRL Quality Assurance (QA) Requirements**

In accordance with EPA Order 5360.1 A2, conformance to ANSI/ASQC E4 must be demonstrated by submitting the quality documentation specified herein. All quality documentation shall be submitted to the Government for review. The Government will review and return the quality documentation, with comments, and indicate approval or disapproval. If the quality documentation is not approved, it must be revised to address all comments and shall be resubmitted to the Government for approval. Work involving environmental data collection, generation, use, or reporting shall not commence until the Government has approved the quality documentation. The quality documentation shall be submitted to the Government at least thirty (30) days prior to the beginning of any environmental data gathering or generation activity in order to allow sufficient time for review and revisions to be completed. After the Government has approved the quality documentation, the Contractor shall also implement it as written and approved by the Government. Any EPA-funded project/program may be subject to a QA audit.

**TO BE SUBMITTED PRE-AWARD (mark all that apply):**

☐ **NRMRL's Quality System Specifications:**

- (1) a description of the organization's Quality System (QS) and information regarding how this QS is documented, communicated and implemented;
- (2) an organizational chart showing the position of the QA function;
- (3) delineation of the authority and responsibilities of the QA function;
- (4) the background and experience of the QA personnel who will be assigned to the project; and
- (5) the organization's general approach for accomplishing the QA specifications in the SOW.

- ☐ **Quality Management Plan:** prepared in accordance with R-2 - EPA Requirements for Quality Management Plans (EPA/240/B-01/002) March, 2001,  
<http://www.epa.gov/quality/qs-docs/r2-final.pdf>

**TO BE SUBMITTED POST-AWARD (mark all that apply):**

☐ **NRMRL's Quality System Specifications:**

- (1) a description of the organization's Quality System (QS) and information regarding how this QS is documented, communicated and implemented;
- (2) an organizational chart showing the position of the QA function; 07/14/08 A-2
- (3) delineation of the authority and responsibilities of the QA function;
- (4) the background and experience of the QA personnel who will be assigned to the project; and
- (5) the organization's general approach for accomplishing the QA specifications in the SOW.

☐ **Quality Management Plan:** prepared in accordance with R-2 - EPA Requirements for Quality Management Plans (EPA/240/B-01/002) March, 2001,

<http://www.epa.gov/quality/qs-docs/r2-final.pdf>

☐ **Category I or II Quality Assurance Project Plan (QAPP):** prepared in accordance with R-5 - EPA Requirements for QA Project Plans (EPA/240/B-01/003) March, 2001

<http://www.epa.gov/quality/qs-docs/r5-final.pdf>

**X Category III or IV QAPP:** prepared in accordance with applicable sections of the following NRMRL QAPP Requirements List(s) which is(are) included in this attachment:

☐ **QAPP Requirements for Measurement Projects**

☐ **QAPP Requirements for Secondary Data Projects**

☐ **QAPP Requirements for Research Model Development and/or Application Projects**

**X QAPP Requirements for Software Development Projects**

☐ **QAPP Requirements for Method Development Projects**

☐ **QAPP Requirements for Design, Construction, and/or Operation of Environmental Technology Projects**

## **ADDITIONAL QA RESOURCES:**

EPA's Quality System Website: <http://www.epa.gov/quality/>

EPA's Requirements and Guidance Documents: [http://www.epa.gov/quality/qa\\_docs.html](http://www.epa.gov/quality/qa_docs.html)

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## **NRMRL QAPP REQUIREMENTS FOR SOFTWARE DEVELOPMENT PROJECTS**

### **GENERAL REQUIREMENTS:**

Include cover page, distribution list, approvals, and page numbers.

### **0. COVER PAGE**

Include the Division/Branch, project title, revision number, EPA technical lead, QA category, organization responsible for QAPP preparation, and date.

### **1. PROJECT DESCRIPTION AND OBJECTIVES**

1.1 Describe the software and its intended application.

1.2 State the purpose of the project and list specific project objective(s).

### **2. ORGANIZATION AND RESPONSIBILITIES**

2.1 Identify all project personnel, including QA, and related responsibilities for each participating organization, as well as their relationship to other project participants.

2.2 Include a project schedule that includes key milestones.

### **3. FUNCTIONAL REQUIREMENTS**

- 3.1 Provide a list of the most important functions that the software system must address.
- 3.2 Identify requirements for functionality, external interfaces (includes graphical user interfaces and interfaces which are needed for other programs to call subroutines from the software, as applicable), performance, and design constraints. Each requirement should be uniquely identified and defined such that its achievement is capable of being objectively verified and validated.
- 3.3 Specify computer hardware and operating system requirements.

#### **4. SYSTEM DESIGN**

- 4.1 Provide an overview of the system design (e.g., block diagrams showing relationships between major program modules, hardware devices, and data input/output).
- 4.2 Describe the components and subcomponents of the software design, including databases and internal interfaces. The description should link the software structure to the functional requirements.
- 4.3 Provide the rationale for selecting the proposed hardware and software tools

#### **5. IMPLEMENTATION**

- 5.1 Describe how a working software system is developed from the design specifications.
- 5.2 Describe how the requirements for functionality, external interfaces, performance, and design constraints will be verified and validated.
- 5.3 Describe how release and delivery of the product is managed, including versions for alpha and beta testing.
- 5.4 Describe the procedures for controlling, documenting, and archiving all significant changes to software and hardware.
- 5.5 Identify the archiving software used for controlling, documenting, saving, and recovering changes made to the source code.

#### **6. VALIDATION, VERIFICATION, AND TESTING**

- 6.1 Describe the testing strategy that will be used along with the procedures for each planned test. Testing may include individual module tests, integration tests, system testing, acceptance testing, and alpha and beta testing.
- 6.2 Describe the procedure for checking the correctness of outputs.
- 6.3 Describe how it will be determined if the developed software product conforms to requirements, and whether the software product fulfills the intended use and user expectations. This includes analysis, evaluation, review, inspection, assessment, and testing of the software product and the processes that produced the product.

## **7. DOCUMENTATION, MAINTENANCE, AND USER SUPPORT**

- 7.1 Specify the requirements for project documentation (e.g., requirements and design document, configuration maintenance plan, operations manual, source code, user's guide).
- 7.2 Describe the procedures for maintenance and user support when software or data generated by the project will be distributed outside NRMRL.
- 7.3 Define the methods and facilities used to maintain, store, secure, and document controlled versions and related artifacts of the identified software during all phases of the software life cycle.

## **8. REPORTING**

- 8.1 List and describe the deliverables expected from each project participant.
- 8.2 Specify the expected final product(s) that will be prepared for the project (e.g., software, user documentation, user interface).

## **9. REFERENCES**

Provide references either in the body of the text as footnotes or in a separate section.



**ATTACHMENT #3 TO THE PWS  
FOR MEASUREMENT PROJECTS**

**NRMRL Quality Assurance (QA) Requirements**

In accordance with EPA Order 5360.1 A2, conformance to ANSI/ASQC E4 must be demonstrated by submitting the quality documentation specified herein. All quality documentation shall be submitted to the Government for review. The Government will review and return the quality documentation, with comments, and indicate approval or disapproval. If the quality documentation is not approved, it must be revised to address all comments and shall be resubmitted to the Government for approval. Work involving environmental data collection, generation, use, or reporting shall not commence until the Government has approved the quality documentation. The quality documentation shall be submitted to the Government at least thirty (30) days prior to the beginning of any environmental data gathering or generation activity in order to allow sufficient time for review and revisions to be completed. After the Government has approved the quality documentation, the Contractor shall also implement it as written and approved by the Government. Any EPA-funded project/program may be subject to a QA audit.

**TO BE SUBMITTED PRE-AWARD (mark all that apply):**

☐ **NRMRL's Quality System Specifications:**

- (1) a description of the organization's Quality System (QS) and information regarding how this QS is documented, communicated and implemented;
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- (3) delineation of the authority and responsibilities of the QA function;
- (4) the background and experience of the QA personnel who will be assigned to the project; and
- (5) the organization's general approach for accomplishing the QA specifications in the SOW.

☐ **Quality Management Plan:** prepared in accordance with R-2 - EPA Requirements for Quality Management Plans (EPA/240/B-01/002) March, 2001,

<http://www.epa.gov/quality/qs-docs/r2-final.pdf>

**TO BE SUBMITTED POST-AWARD (mark all that apply):**

☐ **NRMRL's Quality System Specifications:**

(1) a description of the organization's Quality System (QS) and information regarding how this QS is documented, communicated and implemented;

(2) an organizational chart showing the position of the QA function; 07/14/08 A-2

(3) delineation of the authority and responsibilities of the QA function;

(4) the background and experience of the QA personnel who will be assigned to the project; and

(5) the organization's general approach for accomplishing the QA specifications in the SOW.

- **Quality Management Plan:** prepared in accordance with R-2 - EPA Requirements for Quality Management Plans (EPA/240/B-01/002) March, 2001, <http://www.epa.gov/quality/qs-docs/r2-final.pdf>

- **Category I or II Quality Assurance Project Plan (QAPP):** prepared in accordance with R-5 - EPA Requirements for QA Project Plans (EPA/240/B-01/003) March, 2001 <http://www.epa.gov/quality/qs-docs/r5-final.pdf>

**X Category III or IV QAPP:** prepared in accordance with applicable sections of the following NRMRL QAPP Requirements List(s) which is(are) included in this attachment:

**X QAPP Requirements for Measurement Projects**

- **QAPP Requirements for Secondary Data Projects**
- **QAPP Requirements for Research Model Development and/or Application Projects**
- **QAPP Requirements for Software Development Projects**
- **QAPP Requirements for Method Development Projects**
- **QAPP Requirements for Design, Construction, and/or Operation of Environmental Technology Projects**

**ADDITIONAL QA RESOURCES:**

EPA's Quality System Website: <http://www.epa.gov/quality/>

## **NRMRL QAPP REQUIREMENTS FOR MEASUREMENT PROJECTS**

### **GENERAL REQUIREMENTS:**

Include cover page, distribution list, approvals, and page numbers.

### **0. COVER PAGE**

Include the Division/Branch, project title, revision number, EPA technical lead, QA category, organization responsible for QAPP preparation, and date.

### **2. PROJECT DESCRIPTION AND OBJECTIVES**

- 1.1 Describe the process and/or environmental system to be evaluated.
- 1.2 State the purpose of the project and list specific project objective(s).

### **3. ORGANIZATION AND RESPONSIBILITIES**

- 2.1 Identify all project personnel, including QA, and related responsibilities for each participating organization, as well as their relationship to other project participants.
- 2.2 Include a project schedule that includes key milestones.

### **4. SCIENTIFIC APPROACH**

- 3.1 Describe the sampling and/or experimental design that will be used to generate the data needed to evaluate the projective objective(s). A description of the design should include the types and numbers of samples (including QC and reserve samples), the design of the sampling network, sample locations and frequencies, and the rationale for the design.
- 3.2 Identify the process measurements (e.g., flow rate, temperature) and specific target analyte(s) for each sample type.
- 3.3 Describe the general approach and the test conditions for each experimental phase.

## **5. SAMPLING PROCEDURES**

- 4.1 Describe any known site-specific factors that may affect sampling procedures as well as all site preparation (e.g., sampling device installation, sampling port modifications, achievement of steady-state) needed prior to sampling.
- 4.2 Describe or reference each sampling procedure (including a list of equipment needed and the calibration of this equipment as appropriate) to be used. Include procedures for homogenizing, compositing, or splitting of samples, as applicable.
- 4.3 Provide a list of sample containers, sample quantities to be collected, and the sample amount required for each analysis, including QC sample analysis.
- 4.4 Specify sample preservation requirements (e.g., refrigeration, acidification, etc.) and holding times.
- 4.5 Describe the method for uniquely numbering each sample.
- 4.6 Describe procedures for packing and shipping samples, including procedures to avoid cross-contamination, and provisions for maintaining chain-of-custody (e.g., custody seals and records), as applicable.

## **5 MEASUREMENT PROCEDURES**

- 5.1 Describe in detail or reference each process measurement or analytical method to be used. If applicable, identify modifications to EPA-approved or similarly validated methods.
- 5.2 If not provided in Section 5.1 or the referenced method, include specific calibration procedures, including linearity checks and initial and continuing calibration checks.

## **6 QUALITY METRICS (QA/QC CHECKS)**

- 6.1 For each process measurement and analytical method, identify the required QC checks (e.g., blanks, control samples, duplicates, matrix spikes, surrogates), the frequencies for performing these checks, associated acceptance criteria, and corrective actions to be performed if acceptance criteria are not met.
- 6.2 Any additional project-specific QA objectives (e.g., completeness, mass balance) shall be presented, including acceptance criteria.

## **7 DATA ANALYSIS, INTERPRETATION, AND MANAGEMENT**

- 7.1 Identify the data reporting requirements, including data reduction procedures specific to the project and applicable calculations and equations.
- 7.2 Describe data validation procedures used to ensure the reporting of accurate project data.

7.3 Describe how the data will be summarized or analyzed (e.g., qualitative analysis, descriptive or inferential statistics) to meet the project objective(s).

7.3.1- If descriptive statistics are proposed, state what tables, plots, and/or statistics (e.g., mean, median, standard error, minimum and maximum values) will be used to summarize the data.

7.3.2- If an inferential method is proposed, indicate whether the method will be a hypothesis test, confidence interval, or confidence limit and describe how the method will be performed.

7.4 Describe data storage requirements for both hard copy and electronic data.

## **8 REPORTING**

8.1 List and describe the deliverables expected from each project participant responsible for field and/or analytical activities.

8.2 Specify the expected final product(s) that will be prepared for the project (e.g., journal article, final report).

## **9. REFERENCES**

Provide references either in the body of the text as footnotes or in a separate section.

TECHNICAL APPROACH/OBJECTIVES

INSTRUMENTATION/EQUIPMENT EXPECTATIONS

QUALITY ASSURANCE

DELIVERABLES

SCHEDULE of DELIVERABLES

<b>EPA</b> United States Environmental Protection Agency Washington, DC 20460 <b>Work Assignment</b>						Work Assignment Number 4-010													
						<input type="checkbox"/> Other <input type="checkbox"/> Amendment Number:													
Contract Number EP-C-15-008			Contract Period   04/01/2015   To   03/31/2020 Base                      Option Period Number       4			Title of Work Assignment/SF Site Name See attached PWS													
Contractor JACOBS TECHNOLOGY INC.					Specify Section and paragraph of Contract SOW Section 1.0- 6.0														
Purpose: <input checked="" type="checkbox"/> Work Assignment <input type="checkbox"/> Work Assignment Close-Out <input type="checkbox"/> Work Assignment Amendment <input type="checkbox"/> Incremental Funding <input type="checkbox"/> Work Plan Approval					Period of Performance  From   04/01/2019   To   03/31/2020														
Comments: Work Plan due 4/29/19.  No work, including but not limited to preparation of the Work Plan, shall begin until 4/1/19.																			
<input type="checkbox"/> Superfund					Accounting and Appropriations Data					<input checked="" type="checkbox"/> Non-Superfund									
SFO <input type="checkbox"/> (Max 2)										Note: To report additional accounting and appropriations date use EPA Form 1900-69A.									
Line	DCN (Max 6)	Budget/FY (Max 4)	Appropriation Code (Max 6)	Budget Org/Code (Max 7)	Program Element (Max 9)	Object Class (Max 4)	Amount (Dollars)	(Cents)	Site/Project (Max 8)	Cost Org/Code									
1																			
2																			
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5																			
Authorized Work Assignment Ceiling																			
Contract Period:                      Cost/Fee:                      LOF:																			
04/01/2015   To   03/31/2020																			
This Action:																			
Total:																			
Work Plan / Cost Estimate Approvals																			
Contractor WP Dated:                      Cost/Fee                      LOE:																			
Cumulative Approved:                      Cost/Fee                      LOE:																			
Work Assignment Manager Name   Amara Holder  <div style="display: flex; justify-content: space-between;"> <div>_____ (Signature)</div> <div>_____ (Date)</div> </div>							Branch/Mail Code: Phone Number: 919-541-4635 FAX Number:												
Project Officer Name   Robin S. Harris  <div style="display: flex; justify-content: space-between;"> <div>_____ (Signature)</div> <div>_____ (Date)</div> </div>							Branch/Mail Code: Phone Number: 919-541-0955 FAX Number:												
Other Agency Official Name  <div style="display: flex; justify-content: space-between;"> <div>_____ (Signature)</div> <div>_____ (Date)</div> </div>							Branch/Mail Code: Phone Number: FAX Number:												
Contracting Official Name   Keith Pfeffer  <div style="display: flex; justify-content: space-between;"> <div>_____ (Signature)</div> <div>_____ (Date)</div> </div>							Branch/Mail Code: Phone Number: FAX Number:												

## **Performance Work Statement**

This work assignment is a follow-on to work performed in Option Period 1 under WA 1-010

WA Title: Biomass Burning Emissions Measurement

WA #: 4-010

WACOR: Amara Holder

Contract #: EP-C-15-008

Alternate WACOR: Brian Gullett

### **PERIOD OF PERFORMANCE**

April 1, 2019 through March 31, 2020.

### **SUMMARY OF OBJECTIVES**

The key objectives of this work assignment are to:

1. Prepare and maintain the open burn test facility.
2. Obtain and prepare fuels for biomass burning experiments and provide analysis of fuels and samples.
3. Provide support in the setup and operation of continuous emissions measurements.
4. Provide support in the maintenance of sampling equipment and logistics to support field sampling efforts by the WACOR.

### **BACKGROUND**

Wildland fires are the largest contributor to particulate matter emissions in the United States. However, the emissions from open burning and their impact on surrounding communities are not well constrained due in part to the large uncertainty in emission factors of pollutants. Although numerous laboratory studies and several field measurement campaigns have been carried out, accurate emission factors for particulate matter including compositional information are scarce. Furthermore, these data are averaged over the duration of a burn and do not account for differences in emission rates and compositions during the burn. Open burning of biomass can undergo multiple combustion phases (flaming, smoldering, glowing) both simultaneously and sequentially. The amount of fuel consumed or time spent in a combustion phase can vary depending upon the type of fire (wildfire or prescribed) and the type of fuels consumed in the fire (e.g., crown fuels, litter, or peat).

This project is a continuation of previous efforts to characterize gas phase and particulate matter emissions from the combustion of biomass fuels resolved by combustion phase. In previous work the EPA WACOR has developed an automated sampling platform and experimental plan. This work is a continuation of the experimental plan in which more fuels representative of different regions in the US will be burned.

### **SCOPE**

The scope of this work assignment shall be to provide support in carrying out biomass burning experiments and expanding this work to additional pollutant measurements as specified by the WACOR. This work assignment shall include any additional setup of additional emissions



measurements, preparation and maintenance of the open burn test facility, and general support for biomass burning experiments. Experimental support includes obtaining and preparing fuels, sample analysis, operation of continuous emissions measurements. Each of these activities are described in detail below.

## **TECHNICAL APPROACH/OBJECTIVES**

### **Task 1: Prepare and maintain the Open Burn Test Facility**

The Contractor shall be responsible for preparing the Open Burn Test Facility for burning experiments and maintain all materials associated with the facility. The facility consists of a control room, stainless burn chamber, and a high volume blower which pulls ambient air into the burn chamber and through an exhaust duct out to the blower. The Contractor shall be responsible for cleaning the chamber on an as needed basis. Cleaning shall be needed approximately 5 times as major fuel changes occur. The Contractor shall be responsible for the maintenance or repair of the blower and baghouse system to minimize interruptions to the experimental schedule.

### **Task 2: Obtain and prepare biomass fuels for biomass burning experiments and provide analysis of fuels and samples**

The Contractor shall obtain and prepare biomass fuels for burning as specified by the WACOR. Approximately 2 fuels shall be burned during the period of performance. Any fuel remaining after experimentation has ceased shall be disposed of by the Contractor. For each type of fuel, the Contractor shall provide analysis as specified by the WACOR. Analysis of the fuel shall include but not be limited to: proximate analysis, ultimate analysis, elemental analysis of trace compounds of interest (for example, Pb).

The Contractor shall provide analysis of emissions samples provided by EPA on an as needed basis. Less than 50 samples shall be generated for analysis. Emissions analysis shall include and is not limited to:

- Gravimetric analysis
- Ion chromatography
- Elemental analysis
- Elemental carbon and organic carbon analysis

### **Task 3: Provide support in the setup and operation of continuous emissions measurements.**

The Contractor shall provide support as necessary in the modification of a continuous emissions measurement (CEM) bench. The assembly shall be done to support the addition of emissions measurement instrumentation. Technical direction as to the level of support will be provided at that time by the WACOR. Assembly of the CEM bench shall include, but not be limited to:

- Heated sample lines and controllers
- Heated filter and controller
- Heated sampling pump and controller
- Water removal system

- Carbon dioxide/carbon monoxide analyzer
- Total hydrocarbon analyzer
- Nitrogen oxides analyzer
- FTIR analyzer
- Mercury sampler
- Data acquisition system

The CEM bench shall be assembled from on-site materials provided by EPA and supplemented with necessary additional materials purchased by the contractor.

The Contractor shall operate the bench during routine experimentation according to EPA measurement methods as provided by the WACOR. The Contractor shall purchase calibration gases as necessary to meet method requirements. Calibration gases remaining at the end of the project may be returned to the vendor unless otherwise useful to EPA. The Contractor shall provide data analysis to meet method requirements. Environmental data obtained during the testing shall be subject to quality assurance requirements (Attachment 1 to this PWS). The Contractor shall provide a review of the quality assurance project plan to support Task 2 provided by the WACOR and provide edits if necessary to cover environmental data obtained by the Contractor.

**Task 4: Provide support in the maintenance of sampling equipment and logistics to support field sampling efforts by the WACOR.**

The Contractor shall provide support as necessary in the maintenance of equipment used to sample in the field as well as logistics regarding purchase, delivery, and shipment of materials, equipment, and supplies. Support shall include calibration of instruments (n=4), purchase and shipment of equipment and supplies to two field efforts within the continental U.S.

**WA SPECIFIC MATERIALS**

Tasks 1, 3, and 4 may require procurement of materials to support the research efforts. Materials may include components needed to modify or repair the assembly of the CEM bench described in Task 3, and expendable supplies and components necessary to support Task 4.

**QUALITY ASSURANCE**

The Contractor shall adhere to and ensure that all applicable QA/QC and safety and health rules and requirements are met. Since this work covers measurements to determine emission factors, the Contractor shall document quality assurance/control data as required for Measurement Projects (see Attachment #1) to this PWS.

A quality assurance project plan (QAPP) has been developed by EPA and has been approved by the contractor. Any modifications or addendums to the QAPP will be provided to and approved by the contractor. Once a modification has obtained approval, it shall be submitted to the EPA QA staff for review and approval. It shall be accompanied by a signature page that is signed by

the contractor's work assignment leader and QA officer to show that they have reviewed and approved the revised QAPP. The contractor shall document this process.

Upon receipt of the signed QAPP, the EPA WACOR and QA manager will review and approve the QAPP and they will add their signatures to the signature page. Work involving environmental data shall not commence until the QAPP has received official approval from the EPA QA staff.

# **ATTACHMENT #1 TO THE PWS**

## **NRMRL QAPP REQUIREMENTS FOR MEASUREMENT PROJECTS**

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**GENERAL REQUIREMENTS:** Include cover page, distribution list, approvals, and page numbers.

### **1. COVER PAGE**

Include the Division/Branch, project title, revision number, EPA technical lead, QA category, organization responsible for QAPP preparation, and date.

### **2. PROJECT DESCRIPTION AND OBJECTIVES**

- 2.1 Describe the process and/or environmental system to be evaluated.
- 2.2 State the purpose of the project and list specific project objective(s).

### **3. ORGANIZATION AND RESPONSIBILITIES**

- 3.1 Identify all project personnel, including QA, and related responsibilities for each participating organization, as well as their relationship to other project participants.
- 3.2 Include a project schedule that includes key milestones.

### **4. SCIENTIFIC APPROACH**

- 4.1 Describe the sampling and/or experimental design that will be used to generate the data needed to evaluate the projective objective(s). A description of the design should include the types and numbers of samples (including QC and reserve samples), the design of the sampling network, sample locations and frequencies, and the rationale for the design.
- 4.2 Identify the process measurements (e.g., flow rate, temperature) and specific target analyte(s) for each sample type.
- 4.3 Describe the general approach and the test conditions for each experimental phase.

### **5. SAMPLING PROCEDURES**

- 5.1 Describe any known site-specific factors that may affect sampling procedures as well as all site preparation (e.g., sampling device installation, sampling port modifications, achievement of steady-state) needed prior to sampling.
- 5.2 Describe or reference each sampling procedure (including a list of equipment needed and the calibration of this equipment as appropriate) to be used. Include procedures for homogenizing, compositing, or splitting of samples, as applicable.
- 5.3 Provide a list of sample containers, sample quantities to be collected, and the sample amount required for each analysis, including QC sample analysis.
- 5.4 Specify sample preservation requirements (e.g., refrigeration, acidification, etc.) and holding times.
- 5.5 Describe the method for uniquely numbering each sample.
- 5.6 Describe procedures for packing and shipping samples, including procedures to avoid cross-contamination, and provisions for maintaining chain-of-custody (e.g., custody seals and records), as applicable.

## **6. MEASUREMENT PROCEDURES**

- 5.1. Describe in detail or reference each process measurement or analytical method to be used. If applicable, identify modifications to EPA-approved or similarly validated methods.
- 5.2. If not provided in Section 5.1 or the referenced method, include specific calibration procedures, including linearity checks and initial and continuing calibration checks.

## **7. QUALITY METRICS (QA/QC CHECKS)**

- 6.1. For each process measurement and analytical method, identify the required QC checks (e.g., blanks, control samples, duplicates, matrix spikes, surrogates), the frequencies for performing these checks, associated acceptance criteria, and corrective actions to be performed if acceptance criteria are not met.
- 6.2. Any additional project-specific QA objectives (e.g., completeness, mass balance) shall be presented, including acceptance criteria.

## **8. DATA ANALYSIS, INTERPRETATION, AND MANAGEMENT**

- 8.1 Identify the data reporting requirements, including data reduction procedures specific to the project and applicable calculations and equations.
- 8.2 Describe data validation procedures used to ensure the reporting of accurate project data.
- 8.3 Describe how the data will be summarized or analyzed (e.g., qualitative

- analysis, descriptive or inferential statistics) to meet the project objective(s).
- 8.3.1 If descriptive statistics are proposed, state what tables, plots, and/or statistics (e.g., mean, median, standard error, minimum and maximum values) will be used to summarize the data.
  - 8.3.2 If an inferential method is proposed, indicate whether the method will be a hypothesis test, confidence interval, or confidence limit and describe how the method will be performed.
  - 8.4 Describe data storage requirements for both hard copy and electronic data.

## **9. REPORTING**

- 9.1 List and describe the deliverables expected from each project participant responsible for field and/or analytical activities.
- 9.2 Specify the expected final product(s) that will be prepared for the project (e.g., journal article, final report).

## **10. REFERENCES**

Provide references either in the body of the text as footnotes or in a separate section.

<b>EPA</b> United States Environmental Protection Agency Washington, DC 20460 <b>Work Assignment</b>						Work Assignment Number 4-010				
						<input type="checkbox"/> Other <input checked="" type="checkbox"/> Amendment Number: 000001				
Contract Number EP-C-15-008			Contract Period   04/01/2015   To   03/31/2020 Base                      Option Period Number       4			Title of Work Assignment/SF Site Name				
Contractor JACOBS TECHNOLOGY INC.					Specify Section and paragraph of Contract SOW					
Purpose: <input type="checkbox"/> Work Assignment <input type="checkbox"/> Work Assignment Close-Out <input checked="" type="checkbox"/> Work Assignment Amendment <input type="checkbox"/> Incremental Funding <input type="checkbox"/> Work Plan Approval					Period of Performance  From   04/01/2019   To   03/31/2020					
Comments: The purpose of this Amendment (000001) is to revise the PWS, as attached.  A revised work plan is due within 20 calendar days.										
<input type="checkbox"/> Superfund					Accounting and Appropriations Data					<input checked="" type="checkbox"/> Non-Superfund
SFO <input type="checkbox"/> (Max 2)										Note: To report additional accounting and appropriations date use EPA Form 1900-69A.
Line	DCN (Max 6)	Budget/FY (Max 4)	Appropriation Code (Max 6)	Budget Org/Code (Max 7)	Program Element (Max 9)	Object Class (Max 4)	Amount (Dollars)	(Cents)	Site/Project (Max 8)	Cost Org/Code
1										
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3										
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5										
Authorized Work Assignment Ceiling										
Contract Period:		Cost/Fee:				LOF:				
04/01/2015   To   03/31/2020										
This Action:										
Total:										
Work Plan / Cost Estimate Approvals										
Contractor WP Dated:					Cost/Fee			LOE:		
Cumulative Approved:					Cost/Fee			LOE:		
Work Assignment Manager Name   Amara Holder  <div style="display: flex; justify-content: space-between;"> <div>_____ (Signature)</div> <div>_____ (Date)</div> </div>							Branch/Mail Code:			
							Phone Number: 919-541-4635			
							FAX Number:			
Project Officer Name   Robin S. Harris  <div style="display: flex; justify-content: space-between;"> <div>_____ (Signature)</div> <div>_____ (Date)</div> </div>							Branch/Mail Code:			
							Phone Number: 919-541-0955			
							FAX Number:			
Other Agency Official Name  <div style="display: flex; justify-content: space-between;"> <div>_____ (Signature)</div> <div>_____ (Date)</div> </div>							Branch/Mail Code:			
							Phone Number:			
							FAX Number:			
Contracting Official Name   Keith Pfeffer  <div style="display: flex; justify-content: space-between;"> <div>_____ (Signature)</div> <div>_____ (Date)</div> </div>							Branch/Mail Code:			
							Phone Number:			
							FAX Number:			

## Performance Work Statement – Amendment 000001

**Note: All Amendment 000001 PWS additions are highlighted in yellow text; all deletions are marked with a black line through the deleted text.**

This work assignment is a follow-on to work performed in Option Period 1 under WA 1-010

WA Title: Biomass Burning Emissions Measurement

WA #: 4-010

WACOR: Amara Holder

Contract #: EP-C-15-008

Alternate WACOR: Brian Gullett

### PERIOD OF PERFORMANCE

April 1, 2019 through March 31, 2020.

### SUMMARY OF OBJECTIVES

The key objectives of this work assignment are to:

1. Prepare and maintain the open burn test facility.
2. Obtain and prepare fuels for biomass burning experiments and provide analysis of fuels and samples.
3. Provide support in the setup and operation of continuous emissions measurements.
4. Provide support in the maintenance of sampling equipment and logistics to support field sampling efforts by the WACOR.

### BACKGROUND

Wildland fires are the largest contributor to particulate matter emissions in the United States. However, the emissions from open burning and their impact on surrounding communities are not well constrained due in part to the large uncertainty in emission factors of pollutants. Although numerous laboratory studies and several field measurement campaigns have been carried out, accurate emission factors for particulate matter including compositional information are scarce. Furthermore, these data are averaged over the duration of a burn and do not account for differences in emission rates and compositions during the burn. Open burning of biomass can undergo multiple combustion phases (flaming, smoldering, glowing) both simultaneously and sequentially. The amount of fuel consumed or time spent in a combustion phase can vary depending upon the type of fire (wildfire or prescribed) and the type of fuels consumed in the fire (e.g., crown fuels, litter, or peat).

This project is a continuation of previous efforts to characterize gas phase and particulate matter emissions from the combustion of biomass fuels resolved by combustion phase. In previous work the EPA WACOR has developed an automated sampling platform and experimental plan. This work is a continuation of the experimental plan in which more fuels representative of different regions in the US will be burned.



## SCOPE

The scope of this work assignment shall be to provide support in carrying out biomass burning experiments and expanding this work to additional pollutant measurements as specified by the WACOR. This work assignment shall include any additional setup of additional emissions measurements, preparation and maintenance of the open burn test facility, and general support for biomass burning experiments. Experimental support includes obtaining and preparing fuels, sample analysis, operation of continuous emissions measurements. Each of these activities are described in detail below.

## TECHNICAL APPROACH/OBJECTIVES

### **Task 1: Prepare and maintain the Open Burn Test Facility**

The Contractor shall be responsible for preparing the Open Burn Test Facility for burning experiments and maintain all materials associated with the facility. The facility consists of a control room, stainless burn chamber, and a high volume blower which pulls ambient air into the burn chamber and through an exhaust duct out to the blower. The Contractor shall be responsible for cleaning the chamber on an as needed basis. Cleaning shall be needed approximately 5 times as major fuel changes occur. The Contractor shall be responsible for the maintenance or repair of the blower and baghouse system to minimize interruptions to the experimental schedule.

### **Task 2: Obtain and prepare biomass fuels for biomass burning experiments and provide analysis of fuels and samples**

The Contractor shall obtain and prepare biomass fuels for burning as specified by the WACOR. Approximately 2 fuels shall be burned during the period of performance. Any fuel remaining after experimentation has ceased shall be disposed of by the Contractor. The contractor shall provide sample storage equipment to store samples before analysis and a sample archive. Sample storage equipment may include a freezer, shelving, and storage containers. For each type of fuel, the Contractor shall provide analysis as specified by the WACOR. Analysis of the fuel shall include but not be limited to: proximate analysis, ultimate analysis, elemental analysis of trace compounds of interest (for example, Pb). The same compounds may be analyzed for ash samples. The contractor shall expect 10 fuel samples and 30 ash samples.

The Contractor shall provide analysis of emissions samples provided by EPA on an as needed basis. ~~Less than 50 samples~~ The following shall be generated for analysis. Emissions analysis shall include and is not limited to:

- Gravimetric analysis – 0 samples
- Ion chromatography – 0 samples
- X-ray fluorescence analysis – 100 samples
- Inductively coupled plasma spectrometry analysis – 350 samples
- ~~- Elemental analysis~~
- Elemental carbon and organic carbon analysis – 0 samples
- Dioxin analysis – 50 samples

- PAH analysis – 50 samples

**Task 3: Provide support in the setup and operation of continuous emissions measurements.**

The Contractor shall provide support as necessary in the modification of a continuous emissions measurement (CEM) bench. The assembly shall be done to support the addition of emissions measurement instrumentation. Technical direction as to the level of support will be provided at that time by the WACOR. Assembly of the CEM bench shall include, but not be limited to:

- Heated sample lines and controllers
- Heated filter and controller
- Heated sampling pump and controller
- Water removal system
- Carbon dioxide/carbon monoxide analyzer
- Total hydrocarbon analyzer
- Nitrogen oxides analyzer
- FTIR analyzer
- Mercury sampler
- Data acquisition system

The CEM bench shall be assembled from on-site materials provided by EPA and supplemented with necessary additional materials purchased by the contractor.

The Contractor shall operate the bench during routine experimentation according to EPA measurement methods as provided by the WACOR. The Contractor shall purchase calibration gases as necessary to meet method requirements. Calibration gases remaining at the end of the project may be returned to the vendor unless otherwise useful to EPA. The Contractor shall provide data analysis to meet method requirements. Environmental data obtained during the testing shall be subject to quality assurance requirements (Attachment 1 to this PWS). The Contractor shall provide a review of the quality assurance project plan to support Task 2 provided by the WACOR and provide edits if necessary to cover environmental data obtained by the Contractor.

**Task 4: Provide support in the maintenance of sampling equipment and logistics to support field sampling efforts by the WACOR.**

The Contractor shall provide support as necessary in the maintenance of equipment used to sample in the field as well as logistics regarding purchase, delivery, and shipment of materials, equipment, and supplies. Support shall include calibration of instruments (n=4), purchase and shipment of equipment and supplies to two field efforts within the continental U.S.

**WA SPECIFIC MATERIALS**

Tasks 1, 2, 3, and 4 may require procurement of materials to support the research efforts. Materials may include components needed to modify or repair the assembly of the CEM bench described in Task 3, and expendable supplies and components necessary to support Task 4. Equipment such as a freezer, shelving, and sample containers may be needed for Task 2.

Sampling consumables such as reference standards, sample tubes, and extraction chemicals may be needed for Task 2.

## QUALITY ASSURANCE

The Contractor shall adhere to and ensure that all applicable QA/QC and safety and health rules and requirements are met. Since this work covers measurements to determine emission factors, the Contractor shall document quality assurance/control data as required for Measurement Projects (see Attachment #1) to this PWS.

A quality assurance project plan (QAPP) has been developed by EPA and has been approved by the contractor. Any modifications or addendums to the QAPP will be provided to and approved by the contractor. Once a modification has obtained approval, it shall be submitted to the EPA QA staff for review and approval. It shall be accompanied by a signature page that is signed by the contractor's work assignment leader and QA officer to show that they have reviewed and approved the revised QAPP. The contractor shall document this process.

Upon receipt of the signed QAPP, the EPA WACOR and QA manager will review and approve the QAPP and they will add their signatures to the signature page. Work involving environmental data shall not commence until the QAPP has received official approval from the EPA QA staff.

# **ATTACHMENT #1 TO THE PWS**

## **NRMRL QAPP REQUIREMENTS FOR MEASUREMENT PROJECTS**

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**GENERAL REQUIREMENTS:** Include cover page, distribution list, approvals, and page numbers.

### **1. COVER PAGE**

Include the Division/Branch, project title, revision number, EPA technical lead, QA category, organization responsible for QAPP preparation, and date.

### **2. PROJECT DESCRIPTION AND OBJECTIVES**

- 2.1 Describe the process and/or environmental system to be evaluated.
- 2.2 State the purpose of the project and list specific project objective(s).

### **3. ORGANIZATION AND RESPONSIBILITIES**

- 3.1 Identify all project personnel, including QA, and related responsibilities for each participating organization, as well as their relationship to other project participants.
- 3.2 Include a project schedule that includes key milestones.

### **4. SCIENTIFIC APPROACH**

- 4.1 Describe the sampling and/or experimental design that will be used to generate the data needed to evaluate the projective objective(s). A description of the design should include the types and numbers of samples (including QC and reserve samples), the design of the sampling network, sample locations and frequencies, and the rationale for the design.
- 4.2 Identify the process measurements (e.g., flow rate, temperature) and specific target analyte(s) for each sample type.
- 4.3 Describe the general approach and the test conditions for each experimental phase.

### **5. SAMPLING PROCEDURES**